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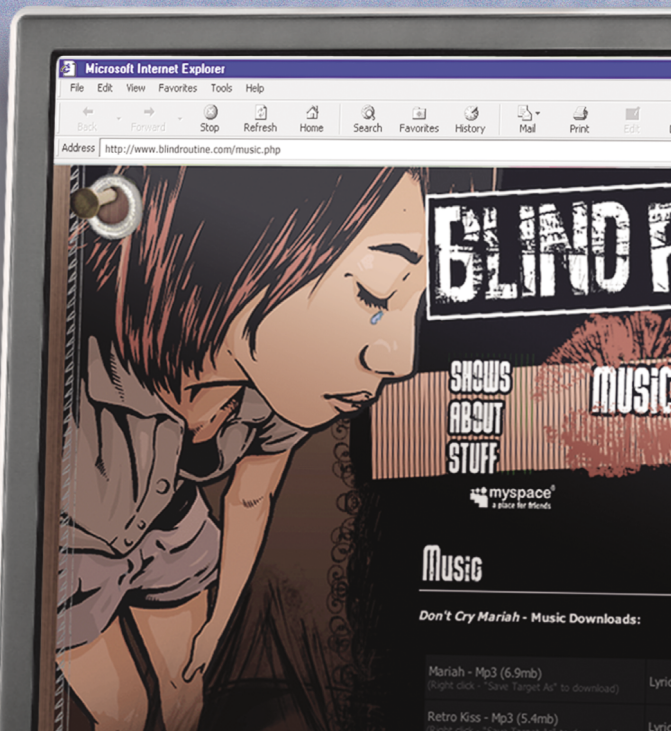
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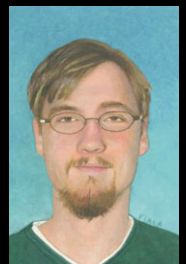
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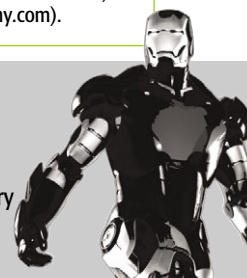
CORRECTIONS:

In the article "Quad-GPU Smackdown" beginning on page 19 of the June issue, we listed AMD and Nvidia as the manufacturer of our test cards. AMD and Nvidia did manufacture the GPUs on those cards, but the cards were manufactured by Sapphire Technology (www.sapphiretech.com) and PNY Technologies (www2.pny.com).

Infinite Loops

Strange stats and other oddball items from computing's periphery

87, 99, 101



"New and improved!"

How often do you see or hear this claim in product ads these days? Seems like you can't swing a bat anymore without hitting some product or other that claims to be vastly better than it was mere moments ago. This inevitably leads the skeptics among us to wonder, a) how can so many products really be that much better than they were last week, last month, or last year, and b) if product x really is so much better, why did I ever subject myself to its older, shoddier predecessor?

Of course, I understand the psychology behind such a sales pitch; saying something is new and improved covers all the bases. If you're already happy with something, just think how much happier it will make you now! On the flip side, if you've never been much impressed with something or simply haven't tried it, you just might be willing to give it a shot and find out for yourself how much newer and better it really is. Sometimes this works (the fifth-generation Ford Mustang, for example), and sometimes it fails spectacularly (remember New Coke?).

I started thinking about this after reflecting on a few items that have come out or are coming out this year that really are (or will be) big improvements over the versions they're replacing, including:

- Western Digital's new VelociRaptor hard drive
- AMD's newest Phenom CPUs
- Intel's Atom Processor
- Integrated graphics in general
- Grand Theft Auto IV
- The new Hulk movie

Granted, the last one is largely an act of optimism, as I haven't seen the Edward Norton version yet, but how can it *not* be better? As for the new Raptor, the new Phenoms, and GTAIV, you'll find out why they made the list later in this issue.

While we're on the subject of new and improved things, I'd be remiss if I didn't mention an upcoming tweak to *CPU*'s content that I feel confident many of you will see as an improvement. I won't spoil the surprise and tell you exactly what this new thing is, but I will say that sometimes making something new and improved means bringing back something good that got lost along the way . . .

Check back with us next month (the August issue) to find out what I'm babbling about, and in the meantime, enjoy our look at the evolution of CPUs and GPUs and where they're headed.



Chris Trumble, Publication Editor, *CPU*



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Gotcha.
Here it is.

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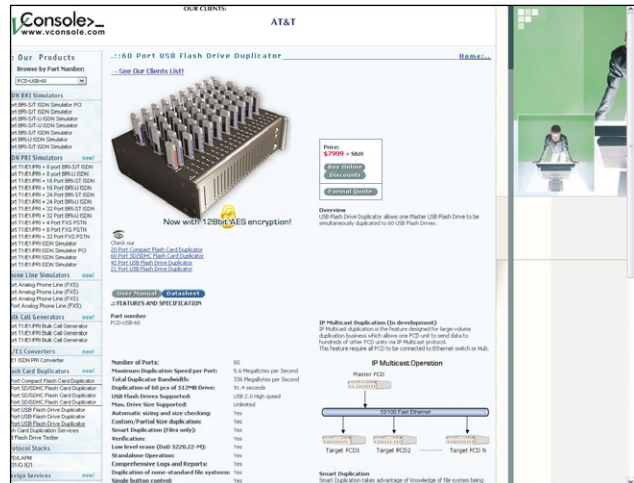
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Flash Drive Duplication 60X Style

If you have \$8,000 and a need to duplicate one master USB flash drive to 60 others in one shot, Virtual Console's (www.vconsole.com) 60 Port USB Flash Drive Duplicator is up to the task. Although on-the-fly 128-bit AES encryption costs extra, the duplicator, which Virtual Console calls the world's fastest, gives you 7MBps writing on each port. That's 420MBps total duplication, for those keeping score at home. Additionally, you don't need a PC to use the thing, although using one provides monitoring abilities. If you buy one, you'll join the ranks of the U.S. Navy and Army, NASA, Halliburton, and Lockheed Martin among those Virtual Console calls clients. ▲



Welcome To The CEA Hall Of Fame

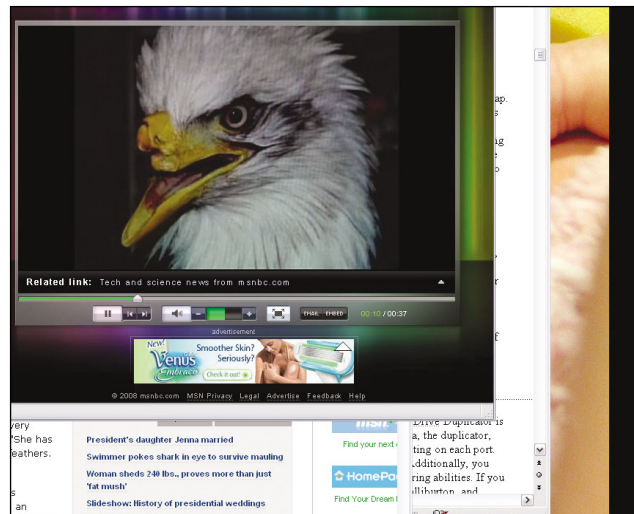
PlayStation owners, Circuit City shoppers, headphone wearers, and cell phone users, it's time to pay respect. In October, the Consumer Electronics Association will welcome 12 new members to its Hall of Fame. Included will be former Sony Computer Entertainment CEO and Chairman Ken Kutaragi, father of the PlayStation; Dr. Fritz Sennheiser, Sennheiser founder and microphone and headphone technology pioneer; Richard Sharp, Circuit City CEO from 1994 to 2006; and Donald Linder and Martin Cooper, leaders of the Motorola engineering team that produced the first mobile phone. Others getting the nod include former Warner Home Video President Warren Lieberfarb, who *Variety* called the father of the DVD, and Dean Dunlavy, who successfully argued Sony's Betamax case in front of the U.S. Supreme Court in 1983. ▲

Purdue U. Builds Supercomputer In A Jiffy

In early May, Purdue University techs aimed to build a supercomputer using 812 Dell servers in one day. Either they undersold themselves or building a supercomputer these days is easier than it used to be, because they finished the job in time for an afternoon nap. Gerry McCartney, university VP for IT and CIO, said an enthusiastic staff and no snags during hardware and software installations had officials "doing science" by noon. Officials named the SC (the largest on a Big 10 campus) Steele after retired Computing Center director John Steele. McCartney said by using commodity computer servers, the techs "didn't have to fly in engineers or hire specialized technicians. We were able to do it with our own IT staff in about four hours." ▲

We Have The Technology

With some luck, love, and ingenuity from a mechanical engineer, Beauty, an Alaskan bald eagle who lost most of her beak years ago due to a hunter, will be eating, drinking, and living more easily soon. Volunteers in Alaska and at the Cantwell's Birds of Prey Northwest Ranch in Idaho have kept Beauty alive by hand-feeding her since finding her in 2005 at an Alaskan landfill on the verge of death. Engineer Nate Calvin and other volunteers have created nylon-composite molds using actual beak parts and computer scans and planned to glue a molding to the 7-year-old Beauty in June. If that fails, they'll try screwing the bionic beak to Beauty's remaining stump. If successful, Birds of Prey's Jane Cantwell says the bionic beak could help Beauty live to 50. ▲



Hardware Mole



Silver Zinc To Extend Notebook Battery Life?

If you've been watching your notebook out of the corner of your eye, worrying its Li-ion battery could burst into flames at any second, rest easy. California battery maker ZPower believes it has a safer alternative. Unlike Li-ion batteries, which contain flammable dimethyl carbonate, ZPower's silver-zinc notebook batteries are water-based. Additionally, the company says the batteries, which reportedly will begin shipping in August, offer "40% more runtime than traditional lithium-ion batteries" and "95% of the primary elements can be recycled and reused." ZPower, which counts Intel Capital among its investors, is also looking to move the battery into mobile devices in coming years. ▲

"Cool Camouflage Pattern!"

Leave it to Iomega to go commando where hard drive storage is concerned. The company's new 250GB Camo Ego USB 2.0 external drive will not only fit right in during your next hunting adventure, it will let you take 1 million photos, 4,625 hours of tunes, or 375 hours worth of movies with you. Drop Guard technology protects against falls, and a Power Grip (all praise to G.I. Joe) "not only looks cool, but also provides desktop stability and extra durability [up to 60-inch drops]." The CAMO runs \$142.45 and doesn't need an external power source. ▲

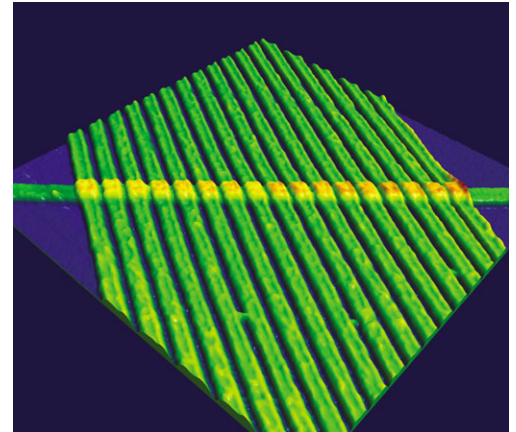


"My, My, Hey, Hey . . .

. . . Rock and roll is on Blu-ray." Neil Young isn't the first rock icon to release musical wares in the Blu-ray format (Bruce Springsteen and AC/DC have previously done so), but he's the first planning to do so in such a massive way. Speaking at Sun's JavaOne Conference in May, Young said he'll release the first of five planned installments of his entire archive on Blu-ray discs. The first 10-disc installment in HD audio will cover Young's 1963 to 1972 recordings. Young—who reportedly will participate in 2010's Automotive X competition after recently converting his 1959 diesel Lincoln Continental Mark IV to run on biodiesel—told JavaOne's crowd, "Putting on a headphone and listening to MP3 is like hell." ▲

HP Surprises The Electronics World With Discovery Of The Memristor

HP researchers show that a long-lost theoretical electrical circuit actually exists. Stan Williams, head of the Information and Quantum Systems Lab at HP Labs, says the research has proven that memristors, or memory resistors, can measure how much electrical current has passed through a wire. It is a fourth circuit to go along with resistors, which resist the flow of electricity; capacitors, which store electricity; and inductors, which resist changes to the flow of electrical current. If memristors can be built affordably, then it could lead to energy-efficient memory chips that can store far more data in a given space than today. They could replace flash memory chips because they store data when a current is turned off and require less silicon, consume less energy, and don't require as many transistors. But engineers have to learn how to design computers with the new components. A memristor stores data as the level of its electrical resistance changes when a current is applied. HP doesn't make chips, but it licenses its inventions to companies that do. ▲



Stanford Initiates Project To Program Multi-Brain Chips

Hardware is racing so far ahead of PC software that researchers at Stanford University are going to start a three-year project to close the gap. The university will explore new models for parallel programming at its new Pervasive Parallelism Lab. Six companies—Advanced Micro Devices, HP, IBM, Intel, Nvidia, and Sun

Microsystems—will contribute \$6 million to the effort. About nine faculty members and 30 graduate students will join the lab. They will address the problem of programming multiheaded chips, dubbed “multicore.” Software programmers haven't learned how to efficiently program code that can take advantage of those

cores, but hardware makers such as Intel are busy adding two, four, eight, 16, or more cores on each chip. ▲

Watching The Chips Fall

Here is pricing information for AMD and Intel CPUs.

*Retail price
** Manufacturer's price per 1,000 units
Other current prices, if indicated, are lowest OEM prices available through Pricegrabber.com

CPU	Released	Original price	Last month's price	Current price
AMD Athlon 64 X2 Dual-Core 6400+ AM2 only	8/20/2007	\$251**	\$169	\$169
AMD Phenom X3 Triple-Core 8750 2.4GHz	3/27/2008	\$195**	\$195**	N/A
AMD Phenom X3 Triple-Core 8650 2.3GHz	3/27/2008	\$165**	\$165**	N/A
AMD Phenom X3 Triple-Core 8450 2.1GHz	3/27/2008	\$145**	\$145**	N/A
AMD Athlon 64 FX-70	11/30/2006	\$599/pair	\$217	\$217
AMD Athlon 64 FX-72	11/30/2006	\$799/pair	\$315	\$315
AMD Athlon 64 FX-74	11/30/2006	\$999/pair	\$329	\$329
AMD Phenom 9550	3/27/2008	\$195**	\$195**	N/A
AMD Phenom 9600	11/19/2007	\$283	\$236	\$236
AMD Phenom 9600 Black Edition	12/23/2007	\$251	\$229	\$229
AMD Phenom 9750	3/27/2008	\$215**	\$215**	N/A
AMD Phenom 9850 Black Edition	3/27/2008	\$235**	\$235**	N/A
Intel Core 2 Duo E6750	7/16/2007	\$183**	\$174	\$179
Intel Core 2 Duo E6850	7/16/2007	\$266**	\$184	\$269
Intel Core 2 Duo E8190 45nm	1/7/2008	\$163**	\$163**	\$163**
Intel Core 2 Duo E8200 45nm	1/7/2008	\$163**	\$173	\$294
Intel Core 2 Duo E8400 45nm	1/7/2008	\$183**	\$204	\$294
Intel Core 2 Duo E8500 45nm	1/7/2008	\$266**	\$450	\$450
Intel Core 2 Quad Q6600	1/8/2007	\$851**	\$219	\$257
Intel Core 2 Quad Q6700	7/16/2007	\$530**	\$279	\$449
Intel Core 2 Quad Q9300 45nm	1/7/2008	\$266**	\$279	\$266**
Intel Core 2 Quad Q9450 45nm	1/7/2008	\$316**	\$496	\$454
Intel Core 2 Quad Q9550 45nm	1/7/2008	\$530**	\$620	\$515
Intel Core 2 Extreme QX6700	11/14/2006	\$999**	\$465	\$1,035
Intel Core 2 Extreme QX6800	7/16/2007	\$999**	\$832	\$1,035
Intel Core 2 Extreme QX6850 3GHz 8MB cache 1,333MHz FSB 65nm	7/16/2007	\$999**	\$979	979
Intel Core 2 Extreme Quad QX9650 3GHz 12MB cache 1,333MHz FSB 45nm	11/12/2007	\$999**	\$1,029	\$1,059
Intel Core 2 Extreme Quad QX9770 3.2GHz 12MB cache 1,600MHz FSB 45nm	2/19/2008	\$1,399**	\$1,489	\$1,599
Intel Core 2 Extreme Quad QX9775 3.2GHz 12MB cache 1,600MHz FSB 45nm	2/19/2008	\$1,499**	\$1,548	\$1,624

Fulcrum Microsystems Expands Its Asynchronous Chip Efforts

After years of effort, Fulcrum Microsystems is starting to make progress on its “asynchronous” chips, which operate without quartz clocks. Such chips can operate faster and at lower power than conventional synchronous chips and have found a home in high-performance networking equipment for data centers. The Calabasas, Calif., company has launched an alliance with nine companies to create an ecosystem for programming software to run on the new chips. Mike Zeile, vice president of marketing, says that the company has more than 80 customers for its chips, particularly those that combine both asynchronous and synchronous components on the same chip, and it recently raised \$29 million in venture capital to expand its efforts. All told, Fulcrum has raised nearly \$100 million. ▲

Congressman Targets Second Life

U.S. Rep. Mark Kirk (R-Ill.), sponsor of the 2007 Deleting Online Predators Act, turned his attention in early May to Second Life. Joining Mount Prospect, Ill.'s mayor and police chief, parents, and teachers at a press conference, Kirk stated, "Sites like Second Life offer no protections to keep kids from virtual 'rape rooms,' brothels, and drug stores. If sites like Second Life won't protect kids from obviously inappropriate content, the Congress will." Kirk reportedly also sent a letter to FTC Chairman William Kovacic requesting "a consumer alert warning about the dangers of Second Life." Linden Lab reportedly countered, "Members of the Second Life community, including Linden Lab staff, actively monitor against minors accessing the (adult portion of the) service." ▲



The Web Is Still A Baby

In a BBC interview coinciding with the 15th anniversary of CERN opening the Web to all users, Tim Berners-Lee said the Web is still in its infancy. "What's exciting is that people are building new social systems, new systems of review, new systems of governance," he said. Berners-Lee added "even though you can find bad stuff out there," the Web will give every user access to "all the data in the world." Berners-Lee onetime CERN co-worker Robert Cailliau said if CERN had put a price on Web connectivity "like the University of Minnesota had done with Gopher," then "we would not have flattened the world." ▲

China vs. United States: It's A Tie

Citing data from the China Internet Network Information Center, the Xinhua News Agency recently reported China has tied the United States for the largest number of people online at 221 million users. Notorious for its Web-censorship practices, China stills falls behind several countries in online commerce. Still, China's Web-connected population skyrocketed from 137 million reported in 2007, a 61% increase, and Xinhua reports only 16% of the population is even online yet, compared to a world average of 19%. Pew Internet and American Life Project estimates U.S. online penetration at more than 70%. ▲

Site Seeing

ZAC Gives Autistic Children Web Goodies

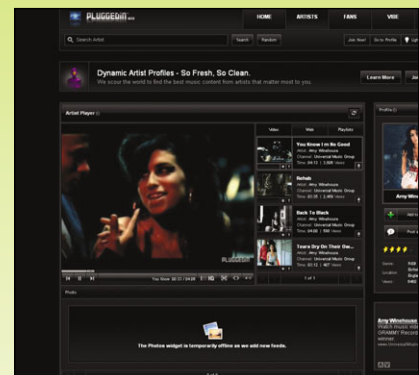


There's a chance your little ones are already tooling around the Web using Kidz CD, a browser PeopleCD designed specifically for kids. Now, the company is aiming its ZAC Browser (Zone for Autistic Children; www.zacbrowser.com) at children with autism and related disorders. PeopleCD's John LeSieur says ZAC's genesis stemmed from his grandson Zackary being diagnosed in 2005 as being severely autistic. Beyond opening to a graphically soothing aquarium-style Desktop, the free browser includes games, movies, stories, a forum for parents and caregivers, and resource links. ▲

The Fresh Prince Plugs In

"Now this is a story all about how Will Smith turned Web music videos upside down. . . ." Actually, PluggedIn.com is a

strategic partnership between the part-time rapper's Overbrook Entertainment company and PluggedIn Media Group, which former Amazon.com and Zillow executive Jeff Somers heads up. PluggedIn.com's gorgeous PluggedIn Media Player gives you full-screen access to 10,000-plus "broadcast-quality" music videos, including many in HD, from Sony BMG, EMI, and independent label artists. Search functions, 1 million-plus artist profiles, and personalization and social networking features are also built in. Oddly, while you'll find Deep Purple, DJ Jazzy Jeff is nowhere to be found. ▲



Video Games Don't Breed Killers

That, according to a new book from a Harvard husband and wife team released in April called "Grand Theft Childhood: The Surprising Truth About Video Games and What Parents Can Do." (Coincidentally, GTAIV was released shortly after the book to the tune of \$500 million in *first week* sales.) Lawrence Kutner and Cheryl Olson spent two years with 1,200-plus junior high-aged students actually, get this, talking to them. Interestingly, their studies found M-rated games are especially popular among girls. Additionally, the studies indicated a pattern of more aggressive behavior among boys and girls playing M-rated games, but Kutner stated, "What I hope people realize is that there is no data to support the simple-minded concerns that video games cause violence." ▲



News Flash: Hiring Hackers Is Risky

Evidently there's legitimate money in being a hacker, even if you switch your white hat for a black one on the job. Reportedly, Christopher Tarnovsky was one of two hackers News Corp., the Robert Murdoch-owned media empire, kept on payroll. During a court hearing stemming from a \$900 million lawsuit that DISH has filed against News Corp., executive Abraham Peled stated Tarnovsky was not only an employee, he was kept on staff after News Corp. learned he posted a hack to unscramble DISH's network in 2001. Further, he was given a bonus the same month he did it and remained employed until 2007. Ouch. Peled did state, "Obviously, there's a theoretical risk [in hiring hackers]." You think? ▲

Linux File System Developer Convicted Murderer

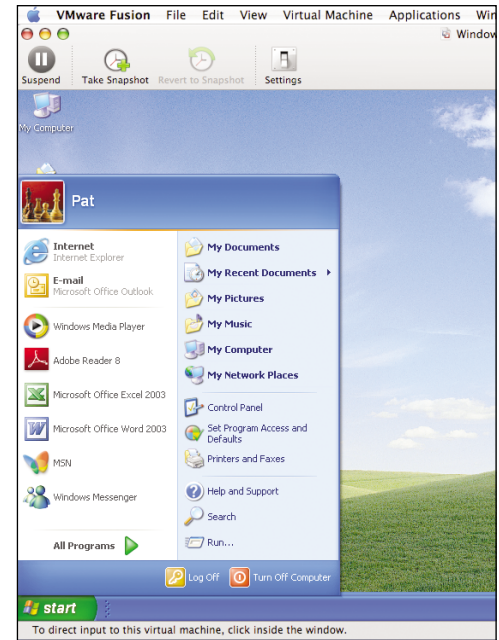
Arrogant, self-centered, and possessing a lingering hate for his wife Nina are a few characteristics a juror in the six month-plus murder trial of Hans Reiser, developer of the Linux ReiserFS file system, cited as reasons for convicting Reiser of first-degree murder in late April. Reiser faces 25 years to life in prison at his sentencing scheduled in July in Alameda County Superior Court in California. Although Nina Reiser's body was never found and prosecutors had mostly circumstantial evidence to work from, juror Vince Dunn reportedly stated the fact that batteries from both Nina and Hans Reiser's cell phones were removed after she went missing was a "big piece of the puzzle for me." ▲



Software Shorts

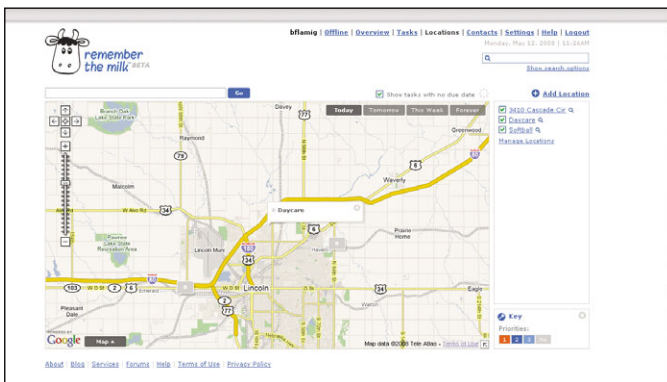
VMware Offers A First For Mac Virtualization

VMware claims its free Beta 1 release of Fusion 2.0 offers Intel-based Macs “the first true multidisplay support to Mac virtual machines.” Released in May, the Fusion 2.0 beta also makes switching from other virtual apps easier, adds 3D graphic acceleration for Windows XP using “experimental” DirectX 9.0 Shader Model 2.0, improves networking support, and makes access to connected USB drives faster. The multiple-monitor ability supports up to 10 screens, and users can drag and drop windows among monitors. On VMware’s blog, the company states, “The team is also extremely happy to announce that VMware Fusion 2.0, when released, will be a free downloadable upgrade for all VMware Fusion 1.x customers, as a sincere thank you to our early supporters.” ▲



Yahoo! & McAfee Bolster Search Security

Yahoo!’s new partnership with McAfee to alert searchers about potentially dangerous Web sites may be a small step toward getting its financial feet back on the ground, but at least it’s a start. Using McAfee’s Site-Advisor technology, the SearchScan feature marks search results deemed risky of adware, spyware, spam, browser exploits, phishing scams, and other nasties with a red triangle. Additionally, Yahoo! is nixing drive-by downloaders from even appearing in results. Site-Advisor, which rates trafficked sites on an ongoing basis, has already been downloaded reportedly more than 135 million times. ▲



Remember The Milk, Web-Style

If you’re like us, you have a spouse who doesn’t take kindly to you forgetting the tasks she asked you to, whether that’s picking up a gallon of milk after work or getting her car serviced. Worry no more. Remember The Milk, a nifty Web 2.0-based app, can help. Rather than a simple list maker, the still-in-beta app sends reminders to you via email, SMS, and IM (Google Talk, AIM, Skype, Jabber, etc.). A MilkSync feature is available for BlackBerry users, as is the ability to add Locations (think Google Maps), tags, and notes. RTM also hooks into Google Calendar, iGoogle, Twitter, and the iPhone and iPod Touch. ▲

BIOS Upgrades Available Online

Compiled by Steve Smith

Before you send another motherboard to the landfill, consider upgrading the BIOS and giving your PC a new lease on life. Here are a few recently released upgrades. Readers can check out www.cpumag.com/cpujul08/bios to see our entire upgrade list.

Motherboard	Date Available	URL
AASRock Penryn1600SLIX3-Wifi 1.10	4/23/2008	download.asrock.com/bios/775/Penryn1600SLIX3-Wifi(1.10).zip
Asus Striker II Extreme 0402	4/14/2008	support.asus.com/download/download.aspx?SLanguage=en-us
Biostar GF8200 M2+ 6.x N78SM408	4/9/2008	www.biostar.com.tw/upload/Bios/N78SM408.BSS
ECS G31T-M (PCB: 1.X) 08/02/27	3/27/2008	www.ecs.com.tw/ECSWebSite/Downloads/DownloadFile.aspx?catid=1&driverid=3904&areaid=2&LanID=9
ECS PT890T-A (PCB: 1.x) 07/12/19	2/25/2008	www.ecs.com.tw/ECSWebSite/Downloads/DownloadFile.aspx?catid=1&driverid=3257&areaid=2&LanID=9
Gigabyte GA-MA790X-DS4 (rev.1.0) F4	3/4/2008	america.giga-byte.com/FileList/BIOS/motherboard_bios_ga-ma790x-ds4_f4.exe
Shuttle SG33G5M SG33SM15	4/17/2008	image.shuttle.com/ResourceCenter/download_file.jsp?file_id=11179

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(6MB Cache, 1066MHz FSB)	
Quad Q6600 2.40GHz	\$1409
(6MB Cache, 1333MHz FSB)	
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Quad Q6600 2.40GHz	\$985
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Quad Q9300 2.50Ghz	\$ 1505
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(6MB Cache, 1333MHz FSB)	
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The Job Search

Slide into one of the hottest new dot coms in widgetland. Slide, one of the largest and best-known social application makers online, needs a Flash Actionscript Developer. The maker of Facebook, MySpace, and Bebo applications such as Fun Wall and Super Poke, Slide is the brainchild of Paypal co-founder Max Levchin. The company claims its applications sit on enough blogs and social networks to reach 150 million uniques worldwide and get over 1 billion HTTP requests a day.

Your job is to build the next great social apps, from games to Web cam integrations to multimedia players. And you will eat well. Recalling the days of the great dot-com excess, Slide boasts a game room, fully stocked kitchen, and gourmet dinners served Monday through Thursday. We guess you're on your own over the weekend. You might try building a Slide app that finds new dinner companions.

<http://tinyurl.com/4rfk6w>

36.2 million
Number of U.S. women
who consult blogs
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33%
Percent of U.S.
seniors
who share photos
over the Web
(Focalyst and DynamicLogic)

13.76%
Share of PCs worldwide
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(OneStat)

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User Reviews: 81% Thumbs Up!

It turns out that consumers may not be the harshest critics. While peer recommendations and user reviews are among the most trusted sources of product information, 81% of online user reviews are positive. According to Bazaarvoice, a UK social commerce company, the overwhelming majority of U.S. user ratings on products and services give four or five out of five stars. Positive and upbeat? Sure, but we Yanks are glum nitpickers compared to UK users, 88% of whom give positive reviews.

www.bazaarvoice.com/pressrelease.php?id=44

10 Stickiest Sites On The Internet

(March 2008)

No, not candy vendors. These sites with the longest hang time per user each month tell us a lot about our most intent digital activities.

Brand	Unique Audience (000)	Time Per Person
PokerStars.com	1,530	9:31:45
Electronic Arts Online	12,112	8:45:59
FullTiltPoker.com	1,289	8:10:40
Trillian	841	7:57:32
Boost Mobile	615	5:22:16
PartyPoker.com	607	5:05:48
FreeSlots	534	4:04:23
AOL Media Network	90,644	3:59:59
Fanfiction.net	1,163	3:48:26
Juno Online Services	4,207	3:34:33

Source: Nielsen Online
www.clickz.com/showPage.html?page=3629238

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Lowered Expectations

It's probably apparent by now that I have a love/hate relationship with PC gaming. The PC is the greatest, most versatile, most promising gaming platform in existence, but the companies most vested in its success (Microsoft, Intel, and game publishers) are constantly botching it for themselves and the rest of us. I have 10 computers in my house and of course can name the system configurations of every one of them off the top of my head, as I'm sure any *CPU* reader can do for their own systems. We're geeks, and we buy a lot of games, but when it's all said and done, we actually only represent about 10% of PC game sales. The folks buying the other 90% have no idea what kind of PCs they have. They're expected to go out to a game shop, pick up a \$40 PC game, and match the litany of system requirements on the side with their own system's capabilities and hope that they won't be disappointed if they buy the game and find it doesn't run well on their PC.

So now I'm in the store mulling the purchase of a copy of *Age of Empires III: The WarChiefs* expansion from Microsoft Game Studios. I notice a Games for Windows logo on the box, which I surmise must imbue the game with some magically enhanced probability of not disappointing me if I take it home. On the back of the box are the system specs my PC needs to run the game:

- Windows XP or higher
- 1.4GHz processor
- 256MB of RAM
- 2GB of available hard drive space
- 32X speed or faster CD-ROM drive
- DirectX 9.0 or later
- 56K dial-up Internet access or LAN
- Sound card and speakers or headphones
- 64MB video card with support for hardware transformation and lighting

Wow, if I weren't a geek I'd drop this box like a hot potato and run for the Nintendo section of the store (which apparently is what consumers are doing). This is less helpful than a Windows Vista warning dialog. Windows XP or higher? Higher than what? Windows XO? Of course, everybody knows that "Vista" is what follows "XP" in Microsoft's version of the alphabet. So this game will run great with

Vista and 256MB of RAM? Should I expect a great multiplayer experience from this game over a modem? I love the last one. What ordinary person knows how much video RAM their PC has, let alone what hardware transformation and lighting even are?

I have a large testing lab at work with hundreds of PC configurations that I can use to test games, but that's no help to most folks who want to know if a PC game will run well on their PC *before* they pay

for it. So before I came to the store, I made use of a fantastic online resource to find out how well the *WarChiefs* expansion would really perform on any given PC. Check out www.yougamers.com, which is run by the folks at Futuremark. This Web site performs online benchmark testing of your PC against the system requirements of a variety of popular PC games and will give you a very good idea of how well your PC will run them before you buy them. I searched our lab for the lowest-specced PC I could find that met *WarChiefs*' stated minimum system specs and ran YouGamer's Game-o-Meter on it.

YouGamer not only tells you if your PC meets the minimum system requirements defined by a game's publisher, but also shows the specs that publisher recommends for best results. In the case of *WarChiefs*, for instance, YouGamers.com correctly detected that the crappy Intel integrated graphics component with 64MB of RAM on my initial test system was insufficient to play the game well and recommended an ATI or Nvidia card with 128MB of RAM as the minimum advisable configuration.

Now I'm ready to buy my Games for Windows-certified copy of *Age of Empires III: The WarChiefs* and take it home, secure in the knowledge that it will play well on at least some of my 10 PCs. Oh, wait a second, what's this in tiny white print on the front of the box? "Expansion Pack: Requires *Age of Empires III* to Play." Whew, glad I noticed that before I took it home and was disappointed again. Looks like the store is out of copies of *Age of Empires III*, so I guess I'd better go shop in the Nintendo section after all. ▲

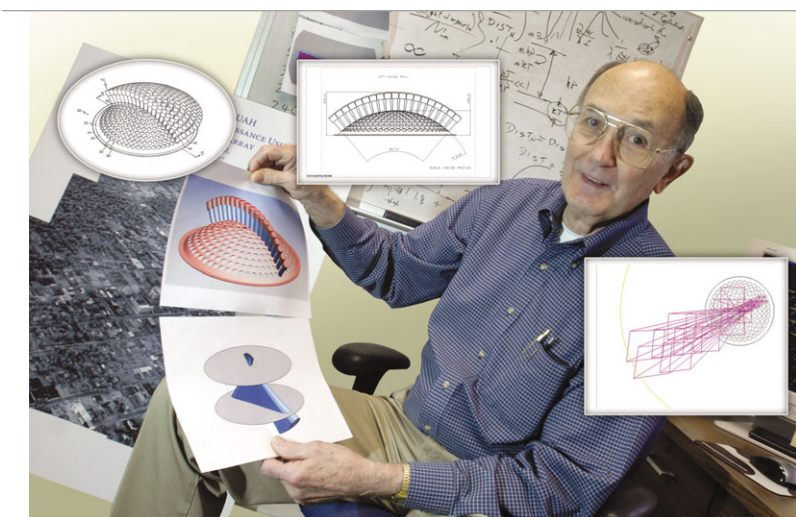


Alex St. John was one of the founding creators of Microsoft's DirectX technology. He is the subject of the book "Renegades of the Empire" about the creation of DirectX and Chromeffects, an early effort by Microsoft to create a multimedia browser. Today Alex is president and CEO of WildTangent Inc., a technology company devoted to delivering CD-ROM quality entertainment content over the Web.

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DREAM HARDWARE

These Gizmos Don't Sing It, They Bring It



“And if two can be one, who is the one two becomes?” Hall and Oates would have tripped over their own lyrical complexity with this month’s Dream Hardware. “If 271 can be one” just isn’t something VH1 viewers are accustomed to hearing.

by Marty Sems

TankChair

Had Cutter John owned a TankChair (www.tankchair.com), the Trekkies of the late, lamented comic strip “Bloom County” would have had one awesome *Enterpoop*. Straight-talking inventor Brad Soden custom-builds these tank-tracked, electric mobility chairs to help disabled clients boldly go where they may never have gone before. His latest models are easily maintainable with standard, off-the-shelf components, except for the special tracks, motors, and computer control modules. Prices start at \$15,600; options are available. Soden is currently working on a seat-leveling system (a TankChair can climb stairs and inclines up to 45 degrees), as well as a sort of echolocation surround-sound system to help blind users navigate. Oh, and keep an eye out for a TankChair to meet a memorable sci-fi fate in the upcoming Jared Hess film, “Gentlemen Broncos.” Drive long and prosper.

SE2 Labs ITC One

Clutter. Noise. Tangles of cables. And remotes for everything. Ambitiously, a new company called SE2 Labs (www.se2labs.com) wants to solve these home-entertainment dilemmas with a single component. Imagine your Wii, Xbox 360, HD DVR, DVD, Blu-ray, stereo, iPod dock, and power conditioning unit all in a single, quietly aircooled box: That’s the goal of the Integrated Theater Console One. And because SE2 Labs turns the aforementioned electronics’ circuit boards into replaceable cards, you can customize your ITC One and replace any part. The \$25,000 asking price seems rather inflated to us, but the TV and speaker options are where you can really get into trouble.

UAH-Sony Gigapixel Camera

An eye in the sky could resemble the eye of a fly. Professor David Pollock at the University of Alabama in Huntsville (www.uah.edu) realized that a 271-lens camera design could drastically expand the field of view and resolution available for airborne and satellite reconnaissance. The camera array could take a gigapixel’s worth of data five times per second, which would then be stitched together into wide-angle surveillance photos with negligible redundancy. The resolution of detail would be about a foot at a 15,000-foot flying height. The camera hasn’t been built yet, just a few prototypes, but UAH and Sony have gone in halves on the patent. ArguSight in Alexandria, Va., supplies the signal processing and data storage, Pollock says, as well as the government contracts. ▲

Pro Graphics Battle Royale

The Latest Workstation Cards Offer Unexpected Value

There was once a time when professional graphics cards sat high and mighty on the pile of consumer-grade 3D accelerators. Names like Evans and Sutherland, Intense3D, 3DLabs, and SGI ruled the roost. If you wanted to play in the big leagues, you had to shell out serious cash. An E&S Freedom, for instance, debuted at \$2,500 back in 1995—and that was a card E&S CEO Jim Oyler hailed as a card for low-cost PCs.

A million miles away in a completely different slice of the graphics market, 3dfx's Voodoo graphics accelerators were selling for less than \$300 and doing a marvelous job making Quake look like an entirely

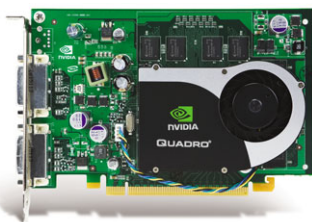
How Much? For What?

Somewhat ironically, the desktop architectures that sprung up to accelerate gaming now serve as the engines propelling high-end boards. Of course, when the transition from highly specialized silicon to more familiar technology began, neither Nvidia nor ATI (before the AMD acquisition) was interested in drawing those parallels. Pro cards were, and still are, super-pricey margin machines compared to mainstream boards. The idea that there's an entertainment-inspired design under the hood hardly sounds corporate.

Nevertheless, the proof is in the numbers. Today's Quadro FX and FireGL

question just begs to be asked: Why bother spending the extra money when you can get 95% of the hardware at a fraction of the price? It's a fair question. But if you come from the professional space, chances are good that you already know why workstation graphics cost more.

There are a couple of reasons for the price premium. First, consider the cards themselves. Although many of the entry-level and midrange boards have similar configurations to desktop models, the higher-end cards sport unique extras that professionals won't find anywhere else. Special memory configurations, HD SDI (High Definition Serial Digital Interface)



Quadro FX 570
\$199 • Nvidia • www.nvidia.com
● ● ● ●



Quadro FX 3700
\$1,599 • Nvidia • www.nvidia.com
● ● ● ● ●



Quadro FX 5600
\$2,999 • Nvidia • www.nvidia.com
● ● ● ● ●

new title, thanks to a little OpenGL rendering. The divide between true workstations and entertainment PCs was a veritable chasm. No way would they ever converge.

We all know how the story really unfolded, though. The dominant force that was 3DLabs is no more. FireGL, once powered by Permedia, Glint, and IBM graphics chips, is now an AMD brand, and the once-mighty SGI filed for Chapter 11 bankruptcy protection two years ago. The tale behind each titan's downfall is different, but there's no denying that the most recognizable names in workstation graphics were all massively impacted by an integration of 3D functionality onto desktop PCs. This much is evident by taking a glance at today's purveyors of professional cards: AMD and Nvidia.

products pack more performance than any of the old workstation architectures. Creative Labs tried resuscitating 3DLabs for another round in the ring, but gaming-driven development cycles and the efforts of large software driver teams kept ATI and Nvidia one step ahead. In 2006, Creative pulled the plug, and it's been a two-horse race ever since.

The entry point for today's professional graphics cards could be the ATI FireGL V3600. It'll cost you about \$200 for a taste of workstation functionality, which is more expensive than a Radeon HD 3870. But don't be surprised if the entry-level card is more capable in professional software.

You see, those same GPUs you find on \$300 gamer cards are driving \$1,500 pro boards. So now that the secret is out, the

support, and optional gunlock (synchronized video) connectivity are but a few of the features available on pricier professional boards. Moreover, hardware overlay planes (used to create windows), accelerated antialiased lines, more sophisticated memory management, and faster pixel read-back speed help justify the added cost beyond what a gaming card can give you.

Then there are the performance advantages attributable to software. For instance, both AMD and Nvidia have special driver packages written to speed up rendering in Autodesk's 3ds Max. The performance drivers won't work with desktop boards, according to Sean Kilbride, technical marketing manager at Nvidia, so the only way to get that extra speed is through an investment in a workstation GPU. Nvidia also

exposes several configuration options in its Quadro FX driver that are simply unavailable to GeForce owners.

Finally, you have the intangible reasons to go pro—certification, support, and a stable product life cycle. It's harder to slap a value on those selling points, but when your business relies on constant uptime, the additional cost of a workstation card is counterbalanced by the dollars AMD and Nvidia spend on enterprise-class R&D. (Think Core 2 versus Xeon.) Just as desktop cards are constantly tested with the latest games and updated for software compatibility, so too are professional cards guaranteed stable in MCAD, DCC, oil/gas, and scientific visualization apps.

From there, you get support commitments not promised with desktop models. Nvidia, for example, provides product support and driver updates for three years after each product's introduction. And longer cycles from both AMD and Nvidia ensure

Nvidia recently rounded out its workstation lineup with the Quadro FX 570, an entry-level card that sells for less than \$200. Despite the seemingly bare-bones price tag, the FX 570 features a G84GL GPU, the business version of what you'd find on a GeForce 8600-series board. It comes with 256MB of memory on a 128-bit memory interface, two dual-link DVI outputs, and full support for DirectX 10 and OpenGL 2.1. The Quadro FX 570 is an excellent entry point into professional graphics.

As you work your way up Nvidia's workstation lineup, it becomes clear that the company has its bases covered. There are four entry-level offerings, three mid-range cards, a pair of high-end boards, and no fewer than five ultra high-end configurations. If you're shopping for a new professional card and not replacing an older model in an already standardized environment, try to keep an eye out for the latest additions to each segment. They're the ones based on

hardware, but you'll find that the card's street price dips under \$800, depending on where you look. For the money, Nvidia's Quadro FX 3700 is an especially bright spot in workstation graphics. Its features are unmatched in the space, and its performance is close to the ultra high-end Quadro FX 5600. A sub-\$1,000 price tag really pulls the card into reach of a much broader audience.

Nvidia's ultra high-end classification is actually peppered with cards sporting current-generation GPUs. The Quadro FX 4600 centers on a G80GL; the FX 4700 X2 sports a pair of G92s; and the company's flagship Quadro FX 5600 offers an even faster G80GL. The 4700 X2 is decidedly a niche product, good for professionals who need four DVI outputs. When it comes to unbridled performance, though, Nvidia's Quadro FX 4600 and 5600 deliver. Complemented by 1.5GB of GDDR3 memory on a 384-bit bus, the FX 5600's



FireGL V7600

\$999 • AMD • www.amd.com



FireGL V7700

\$1,099 • AMD • www.amd.com



FireGL V8600

\$1,899 • AMD • www.amd.com



that when you standardize one system configuration across an organization, parts for those PCs will be available for months, if not years. Believe it or not, IT departments *don't* want to ride the bleeding edge. They want hardware that works flawlessly.

So, although the hefty price tags of workstation graphics cards might be a barrier to entry for prosumers working in content creation or modeling, there are several good reasons to make an investment in professional hardware. After all, performance hardly matters if you're spending hours troubleshooting desktop technology.

Nvidia's Quadro FX

Sensitive to the sticker shock that many corporate types invariably experience when they're quoted high-end boards,

Nvidia's latest GPUs, and consequently equipped with the newest features.

Case in point: The midrange Quadro FX 1700 centers on the same G84GL processor but includes 512MB of memory and TV output. This card sells under the \$500 mark. If you work with a lot of 3D textures or CAD drawings, the extra memory will make a huge difference in performance.

The big step up happens when you go from a midrange to a high-end product, such as the Quadro FX 3700. A G92GL GPU (similar to the GeForce 8800 GT's), 512MB of GDDR3 on a 256-bit bus, and 112 stream processors propel the professional board way beyond the FX 1700.

A \$1,599 MSRP does make the Quadro FX 3700 an intimidating piece of

G80GL processor cranks out 38.4 billion textured pixels per second. It consumes 171W, requires two auxiliary power inputs, and only fits inside an eATX chassis. However, 128 stream processors endow the card with exceptional performance characteristics. The 5600's street price doesn't stray far from its \$2,999 MSRP. But if you're looking at ultra high-end fare, extra speed likely outweighs the substantial price.

AMD's FireGL

You'll see a lot of similarities to Nvidia in how AMD organizes its FireGL lineup. For instance, the company keeps a long list of boards available to customers who may have standardized on a particular model. However, only a handful is based on the current graphics architecture.

The FireGL V3600 is AMD's newest entry-level pro board and based on the RV630 GPU, which you might know from the Radeon HD 2600 Pro. Manufactured at 65nm, the chip packs in 120 unified shaders without the need for an auxiliary power connection. A \$200 price tag puts the card in Quadro FX 570 territory, so it's a good thing that AMD arms its V3600 with 256MB of memory, a 128-bit bus, two dual-link DVI outputs, and full support for DX10/OpenGL 2.1.

Power users looking for more performance will find the same GPU running 200MHz faster in AMD's FireGL V5600. It's also backed by 512MB of GDDR4 memory, yielding significantly more memory bandwidth than the entry-level V3600. Street prices on the FireGL V5600 have dropped significantly in recent weeks; the card is now available for less than \$500. That's right, the V5600 goes head-to-head against Nvidia's Quadro FX 1700 in a battle for midrange affections.

Both the FireGL V3600 and V5600 are great plays on value, to be sure. But the real jewel in AMD's FireGL crown is its brand-new FireGL V7700, based on the RV670 graphics core. The card is a real shot across the bow of Nvidia's Quadro FX 3700, not only because it includes 512MB of memory, a 256-bit bus, and 320 unified shaders but also because it's the first professional board to feature DisplayPort connectivity.

DisplayPort was approved in 2006 but is only just materializing in hardware. The interface supports resolutions up to 2,560 x 1,600 through a cable up to 3m long and will also do 1080p over a 15m cable.

For compatibility reasons, AMD's FireGL V7700 includes one DisplayPort connector and one dual-link DVI output. Priced around \$929, the FireGL V7700 costs about 10 times as much as AMD's desktop Radeon HD 3870 and a couple hundred dollars more than the Quadro FX 3700. However, when it comes to tearing through the A-list professional apps, there is no rival among AMD's lineup.

AMD's top-shelf FireGL cards are the V8600 and V8650, each centering on the original 80nm R600 GPU. Both boards are clocked at the same core/memory

frequencies, slightly below the V7700. The FireGL 8600 features 1GB of on-board GDDR4 memory on a 512-bit bus, while the 8650 boasts 2GB (also on a 512-bit bus). These are the boards to buy if you're using oil and gas software with data sets able to fill up those huge frame buffers. Otherwise, save some money and grab the V7700 for its newer GPU.

Properly Painting A Performance Picture

The tests used to evaluate desktop graphics cards don't apply in the professional world. Nobody cares how many 3DMarks your Quadro FX can push or how far your FireGL will overclock. So, we ran the latest workstation cards through a more apropos suite of relevant software, starting with the synthetic SPECviewperf 10 benchmark. We also used full versions of 3ds Max 2008 and SolidWorks 2008 (provided by Autodesk and SolidWorks, respectively) to test each board in a corresponding SPECapc workload.

We used Windows XP as our test OS because a stable environment is important in the professional space, and representatives at Nvidia let us know that most of its customers are still happily running Windows XP. Nvidia also guided us toward its performance drivers, which don't officially have a thumbs-up from all of Nvidia ISV (Independent Software Vendor) partners. They make a huge impact on performance, though, and have incorporated a number of improvements since the last round of certifications. We were also able to catch an AMD driver update that added support for the FireGL V7700, and it pulled down improved scores in all of our tests.

Although SPECviewperf 10 shows a nice progression moving from the Quadro FX 570 to the 5600, the most telling entry is Nvidia's GeForce 8800 GT, thrown in for the sake of comparison. Clearly, just because the 8800 GT and FX 3700 share a common GPU architecture doesn't mean the two cards handle workstation apps with comparable grace. If you're looking for suitable performance in professional software, even the entry-level Quadro FX 570 will serve you better than a desktop board. The AMD cards don't quite scale as well, which

isn't a bad thing, surprisingly. It turns out that the FireGL V7700's RV670 GPU responded well to its die shrink. And although it doesn't have the V8600's 512-bit memory bus, its faster core and memory clocks yield impressive performance at lower price than the 1GB or 2GB flagships.

The SPECapc 3ds Max benchmark clearly favors Nvidia's cards, thanks to well-placed optimizations in the MAXtreme custom driver. We installed AMD's Maximum driver for 3ds Max, as well, hoping to compare results, but 3ds Max would repeatedly default to the built-in DirectX mode. As a result, all three Quadro FX boards outperform AMD's best efforts by a wide margin. The Quadro FX 5600 especially asserts its high-end pedigree. SolidWorks 2008 was another stronghold for Nvidia. The Quadro FX 3700 and 5600 beat AMD's top offerings there, too.

Professional Graphics Justified

Frankly, it's understandable that workstation cards are sometimes misconstrued as overpriced gaming boards. The two market segments do share common graphics architectures, after all. But when you compare the tangibles (unique memory configurations, stereo output, high-end options such as gunlock) and the intangibles (stable product life, dedicated support, etc.), there are clear reasons for the increased cost.

Then take a look at performance. Desktop boards and their accompanying driver packages were never meant to do the kinds of things asked of workstation offerings. We proved that by watching a \$200 Quadro FX 570 smoke a \$200 GeForce 8800 GT in SPECviewperf 10. If you're using apps like 3ds Max, CATIA, Maya, SolidWorks, Pro/Engineer, or EnSight, a pro card is going to deliver much better results. Even a \$1,000 card pays for itself if it saves you a few hours of troubleshooting during the course of a couple years.

As a lineup, Nvidia's Quadro FX is incredibly complete. It's the most well-represented in the high-end and ultra high-end segments, where support for G-Sync, SDI, and SLI give the cards an edge. And it helps that the Quadro driver package is very mature in WinXP, the OS of choice for workstation users.

AMD has a standout of its own, though. The FireGL V7700's \$1,099 MSRP foretells sub-\$1,000 street prices for a card that boasts ultra high-end performance and

reasonable power consumption. AMD just shipped the first driver version with support for the V7700. Hopefully, with a bit of time, it can bring up performance in the

SPECCap tests to match the exceptional numbers we saw in SPECviewperf 10. ▲

by Chris Angelini

Big Bad Battery Of Pro Benchmarks

These aren't your gamer's benchmarks. We used a variety of tests the professional sphere relies on to gauge performance. As you can see from our GeForce 8800 GT results, there's a reason Quados and FireGLs come at a premium price. ▲

	Nvidia GeForce 8800 GT	Nvidia Quadro FX 570	Nvidia Quadro FX 3700	Nvidia Quadro FX 5600	AMD FireGL V7600	AMD FireGL V7700	AMD FireGL V8600
SPECviewperf 10							
3dsmax-04	5.93	32.29	40.99	41.06	37.52	42	42.03
catia-02	13.18	43.54	50.52	51.72	35.08	39.36	39.22
ensight03	17.69	26.22	44.5	49.64	45.24	54.03	50.97
maya-02	38.31	92.96	192.61	215.52	217.71	248.85	241.42
proe-04	12.08	36.65	39.12	39.11	28.98	33.58	33.92
sw-01	6.11	45.84	69.99	71.15	65.97	74.42	75.58
tcvis-01	3.5	12.32	26.24	28.8	25	31.66	32.1
ugnx-01	6	12.26	28.22	32.07	43.79	55.65	49.92
SPECviewperf 10 (four threads)							
3dsmax-04		42.14	105.25	109.93	87	97.77	94.36
catia-02		61.07	64.85	79.31	56.24	57.13	58.29
ensight03		N/A	N/A	N/A	N/A	N/A	N/A
maya-02		37.35	45.85	46.95	100.36	107.56	108.32
proe-04		N/A	N/A	N/A	33.81	35.76	35.44
sw-01		55.81	96.32	96.76	116.51	137.16	132.02
tcvis-01		N/A	18.29	18.58	21.2	20.18	24.88
ugnx-01		N/A	N/A	N/A			
SolidWorks 2008							
A Day in the Life							
Complete (seconds)		202.1	194.12	191.86	204.08	201.16	200.08
Graphics (seconds)		79.29	76.12	75.33	84.11	82.94	83.07
Processor (seconds)		51.26	49.66	49.16	49.71	48.98	48.7
I/O (seconds)		71.46	68.34	67.37	70.26	69.24	68.31
SPECCap Score		2.18	2.33	2.35	2.18	2.22	2.23
Graphics		2.03	2.26	2.27	1.99	2.04	2.04
CPU		2.41	2.49	2.52	2.48	2.52	2.54
I/O		2.06	2.1	2.11	2.02	2.06	2.09
3ds Max 2008							
Total test time (in seconds)		1064.7	1014.2	964.86	1770.47	1710.42	1686.56
Subcategories							
Wireframe Graphics		3.03	3.05	3.4	2.59	2.35	2.58
Mixed Wire/Shade GFX		2.73	3.49	3.63	2.91	2.91	2.93
Shaded Graphics		3.26	4.3	4.4	4.15	4.17	4.14
Hardware Shaders		6.6	7.74	8.67	6.22	7.01	7.17
Graphics/Texturing/ Lighting/Blending		1.93	2.4	2.8	1.78	2.11	2.17
Inverse Kinematics		2.66	2.68	2.8	1.8	1.82	1.81
Object Creation/ Editing/Manipulation		4.19	4.38	4.77	2.29	2.82	2.83
Scene Creation Manipulation		3.95	4.01	4.24	1.74	1.98	1.98
Rendering		11.91	11.98	12.1	12.03	11.86	11.94
CPU Render		11.91	11.98	12.1	12.03	11.86	11.94
Graphics		2.7	3.28	3.56	2.58	2.77	2.81
Hardware Shaders		6.6	7.74	8.67	6.22	7.01	7.17
Price		\$199	\$1,599	\$2,999	\$999	\$1,099	\$1,899
CPUs		●●●●	●●●●●	●●●●●	●●●●	●●●●●	●●●●●

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

PC Mouse Clubhouse

We Get Touchy-Feely With These Mighty Mice

Anyone who uses a computer for eight hours a day would never ask the question, “Aren’t all mice pretty much the same?” The mouse, along with the keyboard, is the tactile element of our computers that we handle every day. It shapes our computing experience in subtle ways. A junky or skipping mouse makes an otherwise fine computer seem worse, while a slick, feature-filled mouse can make any computing experience better.

To that end, we rounded up a heaping handful of mice and trackballs from the three major mice vendors and got cozy with them, determining not only comfort but also utility and value.

Kensington Ci60 Optical Wireless Mouse

The Ci60 is the only true optical mouse in our roundup (all the others are more correctly called laser mice), so you can still see a warm red glow from its underside during use. You also see it when it isn’t in use, because there’s no power switch. Despite this, the AA batteries should last four to six months. It’s also the largest mouse in our roundup by far, being suitable for anyone with very large hands. Textured rubber grips on the sides are a nice touch (and aren’t common on mice in this low price range). The two thumb buttons are placed perfectly and have excellent tactile feedback, unlike some of the other mice.

**Ci60
Optical
Wireless
Mouse**

\$29.99

Kensington

us.kensington.com



Kensington SlimBlade Media

The SlimBlade Media is a mouse with many unique qualities: It has a slender form factor, a trackball in place of the conventional scroll wheel (*à la* Apple’s Mighty Mouse), and a media control pad on its underside. Its shape, which does nothing to support your palm or side-grasping fingers, is definitely more stylish than ergonomic. It’s also devoid of any extra buttons or sliders. The trackball isn’t clickable, either, so this is really a two-button mouse. And because it comes with only very basic software, you can’t use MouseWorks to assign more functions to them.

Turn the SlimBlade over to expose its media controls, complete with Volume Up/Down, Previous/Next, and Play/Pause buttons within a rubber-coated D-Pad. The mouse has a 35-foot range, which is more than enough to sit on the couch while watching a movie.

Logitech VX Nano

The VX Nano laser mouse is intended either for users with smaller-than-average hands or as a “notebook mouse” that can easily be tucked away in a computer bag. (It even comes with a travel pouch.) Its “nano receiver” is only 5mm long beyond the USB connector, so you can leave it more or less permanently attached to your laptop, even when you stow it in a computer bag.

**SlimBlade
Media
Mouse**

\$59.99

Kensington



Two small buttons next to the right mouse button perform Back and Forward duties, while a button below the scroll wheel performs Internet searches on selected words. All of these buttons are programmable with the included SetPoint software.

The mouse wheel is new, and common to nearly all of Logitech’s new mice. It’s made of heavy metal and carries significant inertia when quickly flicked, allowing for large jumps in scrolling. Pressing down on it silences its ratcheting mechanism and allows for even longer scrolling jumps, and you can rock it side-to-side for horizontal scrolling.

Logitech MX Air

The MX Air is a desktop laser mouse as well as an air mouse. Pick it up and start tilting it to and fro to move the cursor or perform other tasks up to 35 feet away. (Or just move it around your desk like a normal mouse.) As an air mouse, it works beautifully: Its solid-state gyroscopes register gentle tilting and swinging, letting it work regardless of the direction it’s pointed.

Back on your desk, the MX Air suffers from some usability problems. The typical scroll wheel is replaced with a touch-sensitive surface. Gliding your fingertip along it performs the customary scrolling action, complete with a tiny speaker that generates clicks to simulate a ratcheting wheel. Unfortunately, it never seems to scroll as smoothly as a regular wheel, and

VX Nano
\$69.99

Logitech

www.logitech.com



The Specification Rundown

Product	Manufacturer	Number Of Buttons	Range (feet)	Righty/ Ambidextrous	Interface	MSRP	CPUs
Ci60 Optical Wireless Mouse	Kensington	5	6	Righty	USB	\$29.99	3
SlimBlade Media Mouse	Kensington	2	35	Ambidextrous	USB	\$59.99	4
Expert Mouse	Kensington	4	6' cord	Ambidextrous	USB, PS/2	\$99.99	4.5
VX Nano	Logitech	5	60	Ambidextrous	USB	\$69.95	4
MX Air	Logitech	8	30	Ambidextrous	USB	\$149.95	4
Cordless Trackman Optical	Logitech	8	10	Righty	USB, PS/2	\$59.95	4
Cordless Trackman Wheel	Logitech	3	10	Righty	USB, PS/2	\$49.95	3
Wireless Laser Mouse 7000	Microsoft	5	15	Righty	USB	\$69.95	4.5
Natural Wireless Laser Mouse 6000	Microsoft	5	40	Righty	USB	\$79.95	4

the extra buttons running along the mouse's spine all feel the same and are a little awkward to reach, basically requiring you to take your eyes off the screen in order to use them. A desk charger serves as a home for the MX Air when not in use, though its battery can maintain a charge for five days.

Microsoft Wireless Laser Mouse 7000

The Wireless Laser Mouse 7000 is little more than a Wireless Laser Mouse 6000 with a new coat of paint and different power system. The 6000 is a flat silver with glossy black accents and is powered by a pair of AA batteries, which should last about 10 months. The 7000's rechargeable battery lasts for around five days of use. Whenever not in use, the 7000 has a flat cradle that serves as its home and fully charges the mouse in under three hours; a 30-minute charge will provide a few hours of use. Both use a 1.5-inch dongle that give the mice a range of about 18 feet.

The 7000's scroll wheel rolled completely smoothly, without ratcheting or almost any friction, and tilted sideways for horizontal scrolling. Two thumb buttons run along the left side, but they were easy to miss and tricky to click without also

clicking the left mouse button without practice. However, its curvy, molded shape made the 7000 the most comfortable of the "conventional" mice over extended periods.

Microsoft Natural Wireless Laser Mouse 6000

Microsoft's alternative pointing device, having exited the trackball business about three years ago, is also a mouse. The Natural Wireless Laser Mouse 6000 is shaped . . . oddly. Imagine taking a gray baseball, shaving the bottom to make it flat, carving a groove at 10 o'clock for your thumb, and adding four mouse buttons and a rocking scroll wheel to arrive at this unusual shape. The unique form tilts your wrist clockwise compared to other mice, helping relieve carpal tunnel pain and stress by forcing you to use other arm and wrist muscles. It took us three comfortable but annoying days before moving the cursor came naturally.

The scroll wheel has more friction than the Laser Mouse 6000/7000, and the larger thumb buttons are too awkwardly positioned for convenient use. Its large, wired receiver looks rather like a conventional mouse, but it gives the Natural mouse a range of close to 40 feet.

Clickable Conclusions

Kensington's hardware is generally well-built and pleasant to use, but small details seemed a little rougher with Kensington products than with its competition. Buttons seemed to need slightly more force to click, and the scrolling hardware feels a little coarse and notchy at first.

Logitech has more mice and trackballs than all of its competitors put together, so there's a good chance you can find the right combination of size, style, features, and price in a Logitech mouse. The VX Nano and MX Air were exceedingly well put together, with extremely slick antifriction pads, effortless mouse buttons, and even packaging that looks like it came right out of Apple HQ.

It's sometimes easy to forget that Microsoft is in the hardware business, but its mice reflect more than a decade of improvement on the traditional "two-button soap bar." Its trio of mice all came with a slick software package that has a few neat tricks. And well-sculpted shapes of the mice fit the hand well. ▲

by Warren Ernst



MX Air
\$149.99
Logitech
●●●●●



Wireless Laser Mouse 7000
\$69.95
Microsoft
www.microsoft.com
●●●●●



Natural Wireless Laser Mouse 6000
\$79.95
Microsoft
●●●●●

Trackballs

Kensington Expert Mouse

Now in its seventh generation, the Expert Mouse offers the largest trackball (it's nearly billiard ball-sized) with the most surface exposure, four large buttons, a scroll "ring" that surrounds the ball, and the excellent MouseWorks software, making it the best overall trackball. Its large size makes it easy both to make large sweeping movements as well as finely detailed ones, and it works for both righties and lefties. The relatively heavy ball keeps some inertia when it moves fast, making it feel natural, while the built-in wrist rest makes it feel especially comfortable. Oversized buttons encourage different hand positions to distribute muscle wear. Because it's corded, regularly moving it to different sides of the keyboard (to switch hands) is troublesome.

Expert Mouse

\$99.99

Kensington

us.kensington.com



Logitech Cordless Trackman Optical

The Cordless Trackman Optical is built at an angle, making it extremely comfortable, yet also slightly difficult to get used to. Its buttons are oddly placed, and moving the cursor up takes some practice. (It seems like you actually roll it diagonally.) The ball is less exposed than the Expert Mouse, so large movements require more finger movement, and the ball carries less inertia when "thrown" quickly. Odd button placement requires patience to learn before it becomes intuitive (especially the left mouse button), but a large number of programmable buttons can make tasks simpler.

Cordless Trackman

Optical

\$59.95

Logitech

www.logitech.com



Logitech Cordless Trackman Wheel

Looking like a large mouse, the Cordless Trackman Wheel uses your thumb to move the trackball instead of your fingers. Due to how the thumb is built and connected to your hand, this makes horizontal movements easier and faster than vertical movements, which takes getting used to. Like its brother, it is cordless, which could encourage swapping hands once in a while, but it's clearly intended for righties only. It's also a little light in the buttons department, with only two mouse buttons and a scroll wheel.



Cordless

Trackman Wheel

\$49.95

Logitech



Software Makes The Mouse

Much of the functionality of these mice was tied to their software, and, for the most part, manufacturers use the same software with all of their mice. As such, we also pitted our manufacturers' mouse software against one another.

Kensington MouseWorks

MouseWorks, the combination driver and configuration software for Kensington's hardware, allows for configuration options most others don't. It doesn't work with Vista, however. You can enable horizontal scrolling; adjust overall cursor speed, scrolling speed (basically, the number of lines of text per "notch" of the scrolling wheel), and two types of cursor acceleration; and program each of the mouse buttons. Buttons can reproduce keystrokes, perform mouse actions such as double-click or click-and-hold, or open a small program launcher filled with the icons you designate. MouseWorks supports "chording," whereby pressing two buttons together generates a unique mouse-click, and MouseWorks supports the programming of CTRL-Click, ALT-Click, SHIFT-Click, or any combination of keyboard modifiers and mouse buttons. You can even make the same button perform different tasks when running different programs.

CPU rating: ●●●●●

Logitech SetPoint

SetPoint comes with nearly all Logitech's pointing devices. It allows for the typical reprogramming of a mouse's buttons and pointer speed, as well as checks the battery life. A feature unique to SetPoint—and a real benefit to gamers—is its ability to automatically sense when a game loads into memory and then disable its mouse speed and acceleration settings, letting you use the mouse sensitivity settings directly built into most FPS games. This generally allows for more accurate movement and shooting. Judging from Logitech's support forums, this is a longstanding problem. All the Logitech wireless mice seem to need a millisecond to "wake up" after more than a minute of disuse, which is an annoyance not seen in competitive mice.

CPU rating: ●●●●●

Microsoft IntelliPoint

Microsoft IntelliPoint software is slick and well-integrated into the standard mouse driver control panel, instead of a separate window like SetPoint. All buttons are programmable, either on a per-program or global basis, while the Windows XP versions map the clickable mouse wheel as the "Instant Viewer," which is best described as a 2D version of Vista's Flip 3D task switcher. You can set the scroll to varying levels of acceleration: Slow scrolling advances one line at a time, while fast scrolling advances 10, 20, or more lines at a time. It's very useful, yet maintains high precision.

CPU rating: ●●●●●

M12 II

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	Plus certificate PSU (Average efficiency: 84%) Seasonic M12II-500	Non-80Plus certificate 500W PSU (Average efficiency: 68%)
AC Input	595W	735W
DC Output	500W	500W

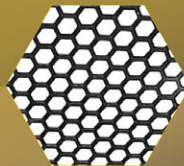
Note : In order to generate 500W of energy, Seasonic PSU only needs 595W of AC input compared with other non-80Plus certificate PSU that needs 735W of AC input. In short, choosing Seasonic PSU will save you 140W just right there!



Seasonic Blue Badge



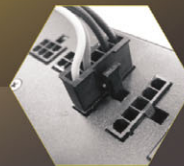
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Honey Comb Structure



High Quality 105°C CAP



Flexible Modular Cables



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Canada distributor:



WWW.SEASONICUSA.COM



Hypersonic Avenger

Power users: When a majority of notebooks have more processing horsepower than your desktop, it's time to replace some of the hardware in the ol' workstation. In the case of Hypersonic's Avenger, outpacing most stationary PCs isn't difficult, though. The diminutive shell is based on Clevo's M72R series, but Hypersonic makes the design its own by painting the chassis with an attractive, flashy, automotive paint finish. The Avenger plays host to an Intel Core 2 Duo T9300 processor based on the 45nm Penryn microarchitecture. It's not the fastest mobile chip that Intel sells, but at 2.5GHz and armed with 6MB of L2 cache, you get solid multitasking and plenty of muscle. It's amazing that the power plant is rated at a scant 35W TDP.

Almost everything about the Avenger is snappy. The GM965 mobile chipset is top-of-the-line mobile fare from Intel. Hypersonic loads that platform with 4GB of OCZ's DDR2-667 memory. There's also a 7,200rpm, 200GB Hitachi Travelstar SATA drive attached to the chipset's ICH8-M (which is loaded with features). Wired Gigabit Ethernet and wireless 802.11a/g/n round out the notebook's suite of performance-oriented features.

If there's one area where the Avenger does come up short, graphics performance is it, which is understandable given a chipset with integrated graphics. On paper, the Intel GMA X3100 is actually respectable. Shader Model 4.0 helps the engine qualify as DirectX 10-capable, while MPEG-2 hardware acceleration improves video playback performance. Intel seems to be lagging with its drivers for the integrated core, which is why you see holes in our PCMark Vantage results. When Intel releases its much-anticipated DX10 update, the Avenger's performance and compatibility should improve substantially. At press time, even Half-Life 2, a moderately demanding FPS, ran below 10fps at 640 x 480 with the detail settings turned down.

Nevertheless, you don't buy a lightweight notebook with a 12.1-inch display expecting high-impact gaming. The

Avenger is a productivity play. Combining a fast dual-core processor, lots of memory, and a 7,200rpm hard drive is a recipe for excellent performance in Office apps, Photoshop, and even Windows Media Encoder. Although it's much more difficult to quantify the general computing experience, we were sitting on the Vista Desktop 40 seconds after powering up the Avenger. Browsing around in IE, navigating network resources, firing up and shutting down desktop apps—it all happened lightning-fast.

A host of little extras complement the Avenger's beefy guts. For instance, there's an integrated Web cam, three USB 2.0 ports, and one FireWire port. An RJ-45 Ethernet port and RJ-11 modem connection handle communications; built-in Bluetooth and 802.11 are available for wireless access. You'll also find a VGA output, front-mounted audio hookups, a 7-in-1 card reader, and an ExpressCard slot.

Hypersonic also arms the Avenger with a DVD±RW burner and a copy of CyberLink's PowerDVD decoder, so we were hoping to see the system make it through an entire DVD movie on one charge. We got about 80 minutes through "Cruel Intentions," though, before an audible warning signaled that our 4-cell battery was sitting at 5%. Anyone anticipating long stretches between wall sockets should definitely grab the optional 8-cell Li-Ion battery. Otherwise, you'll get around 2.5 hours or so of online browsing before it's time to plug in.

By no means is the Avenger an all-purpose powerhouse. It's a sleek, light, attractive laptop with the latest mobile technology finessed into a 21.1-inch shell. If you're tired of hauling around desktop replacements, this thing is a breath of fresh air and a definite attention-getter. ▲



Avenger

\$1,599 (as tested)

Hypersonic

www.hypersonic.com



Benchmark Results

3DMark06 Pro 1.1

Overall	531
SM 2.0	160
HDR/SM 3.0	213
CPU	1046

Cinebench 10

Multithreaded (min:sec)	5:54
Multithreaded (score)	2497

POV-Ray 3.7 Beta

	539.72
--	--------

WME9

VC-1 Hi-Def Encode*	3:27
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PCMark Vantage

Overall	N/A
Memories	N/A
TV And Movies	1679
Gaming	N/A
Music	2391
Communications	2209
Productivity	2072
HDD	3055

Half-Life 2: Episode 2

640 x 480, Low settings	9.48
-------------------------	------

WinRAR 3.71*

	4:50
--	------

*minutes:seconds

**pixels per second

Specs: CPU: 2.5GHz Intel Core 2 Duo Mobile; Memory: 4GB DDR2-667; HDD: 200GB 7,200rpm SATA; Graphics: Intel X3100; 12.1-inch LCD; Vista Home Premium

by Chris Angelini



PLAY SMARTER

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Western Digital VelociRaptor

When it comes to enthusiast-class hard drives, there's one brand that's universally recognizable by speed freaks and RAID-runners alike: Western Digital's Raptor series of SATA drives. It's no mystery why WD's adaptation of its 10,000rpm, enterprise-class product did so well as a high-end desktop product, when you look at the performance advantages of its ultra-low seek times and fantastic sustained transfer rates.

The VelociRaptor is probably the most significant departure from WD's legacy 3.5-inch Raptor product architectures in many years. The drive is based on a 2.5-inch form factor, but it is then encased in a 3.5-inch "sled," dubbed the IcePak, which lets it fit standard drive racks. The sled also acts as a large heatsink.

The only downside is that due to this form factor, the VelociRaptor's data and power connectors are not in the same location as a 3.5-inch drive, which renders it incompatible with any external enclosure, NAS box, or hot-swap bay that needs a standard 3.5-inch SATA port layout.

The drive consists of two 150GB platters spinning at 10,000rpm with four read/write heads and a 16MB cache buffer. Obviously, because the heads travel a shorter distance, the result is a big increase in performance, with a sustained transfer rate of 120MBps vs. 88MBps for the legacy Raptor. WD



VelociRaptor

\$299

Western Digital

www.wdc.com



improved the acoustics, too: There's no whine that plagued legacy Raptors. In short, this new deadly beast offers killer performance. ▲

by Dave Altavilla

Benchmark Results

	VelociRaptor	Raptor 150GB	Caviar SE16 640GB
HD Tach			
Burst Rate (MBps)	255.8	133.5	238.6
Average write (MBps)	96.3	67.8	81.7
Average read (MBps)	104.5	78.1	93
Random access (ms)	7	8	12.7
CPU Utilization (%)	9	3	4
IOMeter			
Total MBpSec	.33	.27	.18
Total I/Ops	167.11	135.81	92.95
CPU Utilization (%)	44	39	34
Max I/O response time (ms)	26.87	27.37	49.36
Average I/O response time (ms)	5.98	7.36	10.75

Specs: 300GB capacity, 16MB cache buffer, 3Gbps SATA, 10,000rpm spindle speed, 4.2ms read/4.7ms write seek time

Asus Eee PC 4G (Windows XP)

When it comes to ultraportable, ultra-affordable notebooks, few products have made the kind of splash as the Asus Eee PC. At the time, the first Eee PCs shipped with a custom KDE-skinned, Linux-based OS. However, there's still a market need for users who can't conceive of jumping to Linux and require broader compatibility.

We took the Eee PC 4G (which has a Windows XP OS) for a ride to get a good feel for how it performs. For starters, disk space is the primary limitation. The 4G has an identical system spec as the initial Eee PC 4G. With its standard complement of Microsoft-issued software (plus MS Works) installed, the machine only has a little over a gig left on its C: drive. At least Asus included a 4GB SDHC card in the bundle.

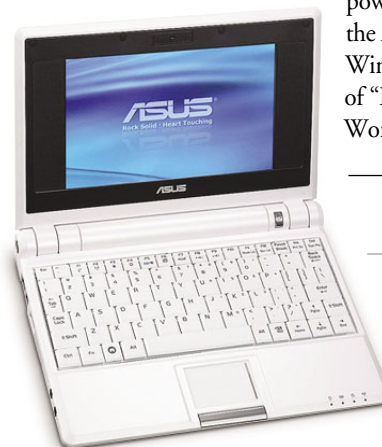
Performance-wise, the machine runs Windows quite fluidly and sports a boot

time of 27 seconds, according to our stopwatch. That's a bit slower than its Linux-based sibling, which boots in about 15 seconds, but a lot faster than we've seen some full-sized notebooks boot Windows.

A quick-take performance check with SiSoft Sandra XII showed the tiny machine well behind some of the Core 2 Duo mobile numbers, at 2,038 ALU Mips and 1,517 iSSE2 Mflops in the CPU test. Sandra's Memory test showed the machine offered 1,352MBps Integer and 1,341MBps

Float Stream test bandwidth. The Eee PC 4G-X shined in Sandra's Physical Disk test, with its flat 33MBps across its entire volume outpacing even a Hitachi TravelStar notebook drive. Although it may not be a powerhouse mobile platform, the Asus Eee PC 4G with WinXP delivers on its mantra of "Easy to Learn, Easy to Work, and Easy to Play." ▲

by Dave Altavilla



Eee PC

\$399

Asus

www.asus.com



Specs: 900MHz Intel Celeron ULV; 512MB DDR2; 4GB SSD; 4GB SDHC card; Networking: 802.11g Wi-Fi, 10/100 Ethernet; Windows XP

SageTV STX-HD100 Media Extender

This is what I like to see when I open a box containing a new piece of hardware: A DVD player-sized device, one Ethernet cable, one audio/video cable, and a remote control (with batteries included). Such a sight greeted me upon opening the box containing the SageTV Media Extender. There was no installation disc, and the instructions were so thin I could read it front to back in less than 10 minutes. I became optimistic that setup would reflect the simplicity of the package's contents.

Indeed, if you already have the SageTV software installed on your computer, setup consists of connecting AV cables to a TV, connecting the network cable to an Ethernet port, and plugging in the media extender's power cord. That's it.

The STX-HD100 does exactly what it should: It lets you stream content from your computer so you can watch it on a TV. Whether it was streaming online video, watching live TV, or retrieving media files from the hard drive, there was no discernible lag nor image or audio degradation. Behold, the power of a wired network.

As simple as the media extender itself may be, you do need the SageTV software to use it. You can download the software directly from SageTV's site, but it'll cost you \$79.95. Then, you have to install and configure the software, which is rather time-consuming and somewhat complicated.

It would've been nice to have a few more options on the Media Extender itself, such as Wi-Fi or a DVD tray, but if you want to watch live TV and online video or stream content from your computer, the Media Extender will get it done. ▲

by Seth Colaner



STX-HD100 Media Extender

\$199.95

SageTV

www.sagetv.com



Specs: Video: HDMI, component, S-Video, composite; Audio: HDMI, optical, analog; Network: Ethernet; Supported video: AVI, ASF, MPEG-1/2/4, MKV, QuickTime, MP4, ASP, H.264, WMV9; Supported audio: MPEG Audio, AAC, AC3, WMA, FLAC

Microsoft Digital Media Keyboard 3000

Following Microsoft's simultaneous announcement of its Wireless Laser Desktop 7000 (\$129.95) and Digital Media Keyboard 3000 this spring, the 7000, or "little black dress of peripherals," amassed most of the attention due primarily to its translucent, Aero-like attire. Despite lacking some of the 7000's trendiness, the 3000 is \$100 less and still crams boatloads of customizability and quick-access buttons in a streamlined frame that's only about an inch high.

To Microsoft's credit, the 3000 doesn't feel at all cramped despite all the built-in functionality. Two rows of logically arranged and nicely spaced hotkeys and Function keys reside across the top, while four keys for zooming and launching My Documents and My Pictures sit at left. The hotkeys will launch a Web mail or desktop email client, Messenger, Windows Media Player, Web browser, and

five Web sites you assign by merely pushing and holding a button (think setting a radio station). The Function keys, meanwhile, toggle several document- and email-based functions (spell check, Undo, Print, Save, etc.). Additionally, a convenient F LOCK key bolts these alternatives in place. Finally, if you're running Vista, a Flip 3D button sits near the Spacebar.

Due to the 3000's thinness, the board had a decided notebook feel while typing. The keys are nearly flat (they're also spill-resistant) and produced little noise or spring, which could take some non-notebook users some getting used to. Additionally, if you've been using an angled, ergonomic board (such as the Microsoft Wireless Comfort Keyboard 4000 that's owned my desk for months), the 3000's flatness and lack of wrist rests may throw you off initially.

Once I made the adjustment, however, typing on the 3000 was a pleasure.

In spite of the 3000's sleekness and mucho customizations/functionality, the board's best asset is certainly its ultra-friendly price. Just a nickel under \$30 gets an extremely rock-solid board with plenty of convenience built in. A June release is expected. ▲

by Blaine Flamig



Digital Media Keyboard 3000

\$29.95

Microsoft

www.microsoft.com



Specs: PC and Mac platforms supported; 7.06 x 17.6 inches (HxW); Flip 3D button; five My Favorites keys; spill-resistant exterior

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Gateway FX7026

The FX7026 isn't designed for high-end enthusiasts, but with a price just below \$1,100 and the goodness of a 2.5GHz Intel Core 2 Quad Q9300 processor, this system is worth considering for gamers on a tight budget.

The midtower case is virtually all black, with a few metallic copper highlights on the front chassis. For aesthetic appeal, the DVD±RW SuperMulti Drive is hidden behind a bay cover with an eject/close button on the chassis, but when we opened it, the drop-down drive doors blocked the eject/close button on the chassis, so we were forced to manually

Specs: CPU: Intel Core 2 Quad Q9300; Motherboard: Intel DG33SXG2 (Intel G33 chipset); Graphics: Nvidia GeForce 8800 GT; HDD: 320GB Western Digital Caviar SE 16 (x2); Memory: 4GB Samsung DDR2-667MHz; PSU: 400W Delta DPS-400GBa; Windows Vista Home Premium (64-bit)

push the tray to close the drive. As you may expect from a midtower, the FX7026 offers limited upgrade potential. For example, there are only two free PCI-E x1 slots for add-on cards and no space in the drive cage for another hard drive.

The Nvidia GeForce 8800 GT drive is factory overclocked with a 625MHz core clock and 925MHz memory clock, but our results didn't show too much improvement over the stock-clock speeds. Performance-wise, the FX7026 won't challenge premium PCs, but the quad-core processor put up respectable scores in our benchmarks nonetheless. The FX7026 posted 5056 overall score in PCMark Vantage Pro and a 10689 multithreaded score in Cinebench 10, which is comparable to some of the top-shelf laptop systems we recently tested. With all of the graphics settings set at Medium in Crysis, the FX7026 cranked

out 28fps, but when we kicked the settings on Crysis to Very High, the GPU Benchmark only recorded 2fps.

The FX7026 offers some decent processing power, but it lacks the graphics punch needed to run DirectX 10 games at the highest settings. That being said, budget-minded gamers may find that the FX7026 offers enough power for their needs.

(NOTE: For full benchmark results, go to www.cpublog.com/cpublog08/gateway.) ▲

by Nathan Lake



FX7026
\$1,099.99
Gateway
www.gateway.com



Boston Acoustics MM 226

Boston Acoustics touts that its MM 226 speakers include BassTrac audio processing, which helps avoid distortion in bass signals that can occur at low frequencies and high volumes. We came away impressed with the bass from these 2.1 speakers, but our listening experience with other aspects was less positive.

At 11.5 inches tall and 3.25 inches wide, the satellites have similar dimensions to Harman Kardon's SoundSticksII. Each speaker features a 2-inch driver and half-inch tweeter. The satellites provided good spatial stereo effects but lacked the ability to cover all the midrange sounds in games, music, and movies. For instance, in the Beatles' "Helter Skelter," the peaks of the primary instruments were clear, but the background symbol

crashes, strumming guitar, and vocals were muddy.

On the plus side, the MM 226's 6.5-inch subwoofer delivered crisp booms when playing videogames and music. For example, in the World in Conflict benchmark, we could clearly differentiate between the blast of the atomic explosion and the smaller booms as the explosion reverberated outward. Boston Acoustics rates the subwoofer at 50 watts RMS/100 watts dynamic, but based on our testing, we would have guessed the subwoofer had bigger numbers. The speakers come with a wired control pod that includes a 1/8-inch mini stereo input and output jack. We like that Boston Acoustic locates the on/off button on the control pod, rather than on the satellites.

With pleasant bass, the MM 226 offers the punch to make games and movies sound realistic, but you may find speakers that do a better job with midrange sounds for a similar price. ▲

by Nathan Lake



MM 226
\$179.99
Boston Acoustics
www.bostona.com





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Scythe Ninja Copper CPU Cooler

To commemorate its fifth year, Scythe released a new copper version of its Ninja CPU cooler. If you're unfamiliar with the Ninja, it's an oversized, tower-type cooler with a hefty base and six heatpipes. However, this anniversary edition of the Ninja CPU cooler eschews the original's aluminum construction in favor of higher-performing copper (save for a small portion of the heatsink).

Compatible with both Intel and AMD platforms, the Ninja Copper's heatsink's fins are relatively far apart. This is ideal for quiet computing applications: As the fan blows air across the fins, the fins create less air turbulence, and hence less noise. And that's only if you use a fan. The Ninja is so large that it can also be used as a fanless cooler, provided there is good air

circulation within the case. Slap a high-RPM fan on the Ninja Copper, and it's ideal for extreme overclockers, as well (although performance was quite good even with the included 800rpm fan).

Installation was fairly painless but does require access to the underside of Intel Socket 775 motherboards. AMD users

have it much easier, as the Ninja clips right onto the standard retention bracket included on virtually all Socket AM2+/AM2/939/940/754 motherboards.

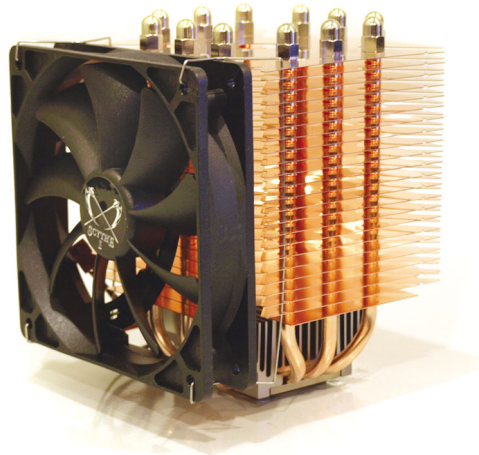
I tested the Scythe Ninja Copper on an open-air test bench with an Asus P5E3 Deluxe and an Intel Core 2 Extreme QX9650 processor. Ambient room temperature during testing was about 22 degrees Celsius. With the processor idling at its

default clock speed of 3GHz, the Ninja Copper kept it running at a relatively cool 35 C; under load, the CPU hit only 52 C. With the CPU

overclocked to 3.66GHz, idle and load temperatures went up to only 39 C and 68 C, respectively.

Considering its strong performance with such a quiet, low-RPM fan, I can't help but like the Ninja Copper. At about \$70, though, it doesn't come cheap. ▲

by Marco Chiappetta



Ninja Copper CPU Cooler

\$70

Scythe

www.scythe-usa.com



Specs: Compatibility: Intel Sockets LGA775/478, AMD Sockets AM2+/AM2/939/940/754; Dimensions: 110 x 110 x 150 mm (HxWxD); Fan: 120mm diameter, 800rpm (±10%); Air flow: 40.17cfm, Acoustics: 10.7 dBA

Diamond Multimedia TV Wonder HD 650

Diamond Multimedia's TV Wonder HD 650 is a virtual carbon copy of ATI's similarly named TV tuner. In fact, the two share the same PCB and Samsung tuner hardware. Diamond did throw in some useful accessories with the TV Wonder HD 650, which include the obligatory drivers disc and manual, an A/V input block, FM antenna, and an AMD Live! software CD.

Like other TV tuner cards based on ATI's Theater 650 chip, the Diamond TV Wonder HD 650 is easy to install and offers some of the best image quality available from a PC TV tuner. Using the ATI Catalyst Media Center, picture quality was excellent, whether the source was an analog cable input or OTA HD. I was

able to switch channels quickly and didn't notice any lag that plagues many other tuners. CPU utilization hovered around 3 to 5%. The TV Wonder HD 650's FM tuning was also good, although the card wasn't able to pick up a couple of

stations that a nearby shelf stereo system could (probably due to the excessive EMI present within a typical PC).

Users in the market for a high-quality, basic TV tuner should consider the Diamond Multimedia TV Wonder HD 650. Users looking for something a little more powerful and flexible, however, would probably be better served by a Theater 650 Combo tuner, which also adds a Clear QAM tuner. ▲

by Marco Chiappetta



TV Wonder HD 650

\$129.99

Diamond Multimedia

www.diamondmm.com



Specs: Interface: PCI; Input Connections: F-Type Coax input (NTSC/ATSC), FM radio, S-video, Stereo audio

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Savaging The Raptor

SSDs That Run Up The Score

There was a minor flap this March when analyst firm Avian Securities asserted that SSD-based notebooks were being returned in droves due to unreliability. However, the report was quickly refuted by Dell (which has shipped more SSD-based laptops than most, if not all, competitors), and its author immediately backed down. Dell said that only 3% of its flash-based laptops were being returned for any reason. Granted, most of the SSDs shipped in notebooks thus far haven't been exactly speed demons, whatever their benefits in shock tolerance, silence, power savings, temperature indifference, and reduced boot times.

Performance is not an issue with some of the latest SLC (single-level cell) models we've tested, notably Memoright's insane GT Series. Put bluntly, the only speed advantage a 3.5-inch Raptor has over these Memorights is in sequential reads of big chunks of data—and only if you stripe two of the 10,000rpm hard drives. (Turn to page 30 in this issue for benchmarks from Western Digital's new 2.5-inch [3.5-inch with its cooling enclosure] Velociraptor.) Mind you, hard drives will remain the mass storage price/capacity king for years to come, even if they're relegated to a nearline role; witness new 750GB hard drives selling for \$120 online.

Meanwhile, Imation is now rebranding 16GB to 64GB SSDs made by Mtron. Its Mobi 3000 line is intended for enthusiasts, and its slightly faster Pro 7000 units are for server use. Imation, like others, indicates that nForce chipsets will yield faster performance with its SSDs, so users with Nvidia-based motherboards should anticipate slightly better performance than we charted with our Intel/Marvell system.

Micron's Lexar Media subsidiary also sent its new Crucial SSD, but a full review will have to wait. Although the Crucial's read rates eclipsed even the Memoright GT's, our eval unit had issues. We'll talk more about it when a replacement unit arrives for testing.

MOBI MSD-SATA3035-064 (SATA 3.5-inch 64GB)

\$1,399

Mtron

www.mtron.net



GT Series MR25.2-064S (SATA 2.5-inch 64GB)

\$2,089

Memoright

www.memoright.cn



GT Series MR25.2-128S (SATA 2.5-inch 128GB)

\$3,819

Memoright



Imation/Mtron specs: 7-bit ECC; 1,500G non-operating shock tolerance (per Imation); 1 million-hour MTBF; dynamic/static wear-leveling; 10-year data retention; 0.5 to 2W power consumption (per Imation); three-year warranty

Memoright specs: 200G operating (2ms)/800G non-operating (1ms) shock tolerance; ECC; 16MB cache; wear-leveling; >10-year data retention; 1 to 2.5W power consumption

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Mobi 3000 MSD-SATA3035-032
(SATA 3.5-inch 32GB)
 \$1,099
 Imation
 www.imation.com
 ●●●●●



Prices are still high for SSDs, especially for the performance models. During this review, the prices on the 64GB and 128GB Memorights actually jumped *upward* \$90 and \$420, respectively. Still, if you care enough to install the very best, the company's GT Series is it.

Or is it? Stay tuned for an interesting review next month. The DTS Platinum drive (www.platinumhdd.com; distributed by DVNation.com) pairs a 2.5-inch hard drive with a stonkin' 1GB of DRAM and a bank of capacitors. The intent is to approach SSDs' performance while undercutting them on price per gigabyte.

(Special thanks to distributor DVNation.com for providing the Memoright and Mtron SSDs.) ▲

by Marty Sems

Faster Than A Speeding Raptor

Test system: Vista Home Premium, Core 2 Duo E6700 2.67GHz, 2GB DDR2 (1,066MHz), Intel D975XBX2KR, Marvell 6145 controller

	Imation 3.5" 32GB MOBI 3000	Memoright 2.5" 64GB GT	Memoright 2.5" 128GB GT	Mtron 3.5" 64GB MOBI	Raptor 150GB WD1500ADFD [RAID 0]
Interface	SATA 150	SATA	SATA	SATA 150	SATA 150
PCMark Vantage 1.0.0 (Nov 07 patch)					
HDD Score (points)	7791	11975	11009	7324	3437 [4264]
Defender (MBps)	64.7	81.5	71.6	57.4	20.1 [22]
Gaming (MBps)	88.8	89.4	80.1	76.5	14.5 [16.5]
Photo Gallery import (MBps)	95.8	96	84.6	81.7	32.7 [35.6]
Vista startup (MBps)	45.1	61.5	55.1	44.2	10.1 [17.1]
Movie Maker edit (MBps)	24.9	58.3	56.6	23.1	27.9 [30.9]
Win Media Ctr (MBps)	33.6	74.8	73.3	32.2	42.6 [56.1]
WMP music add (MBps)	10.6	24.2	22.1	10.6	9 [9.8]
Application Loading (MBps)	13.8	20.6	19.6	14.6	4.2 [6.4]
HD Tach RW 3.0.4.0, Long Bench					
Read rates, average/maximum (MBps)	100.7/101	116.1/117	101.7/103	85.6/86	75.5/88 [129.5/160]
Write rates, average/maximum (MBps)	52.2/53	99.7/101	98.6/99	47.7/48.5	64.7/74 [67.9/92]
Random access time** (ms)	0.1	0.1	0.1	0.1	8.3 [8.4]
Burst read rate (MBps)	104.7	121.1	106.2	88.3	127.5 [178.5]
CPU Utilization** (% +/- 2%)	6	6	4	1	3 [7]
Iometer 2006.07.27					
File Server (IOps)	587	1308	1306	671	185 [269]
File Server (MBps)	6.3	14	14	7.3	2 [2.9]
File Server avg/max response** (ms)	27/137	12/147	12/174	24/130	86/1205 [59/898]
Web Server (IOps)	5115	4107	3562	4430	202 [315]
Web Server (MBps)	77.4	62.4	54.6	67.5	3.1 [4.7]
Web Server avg/max response** (ms)	13/48	16/60	18/65	14/57	317/1570 [203/1139]
Price	\$1,099	\$2,089*	\$3,819*	\$1,399*	\$269.99 [\$539.98]
CPU	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●

* Prices from DVNation.com. ** Lower is better.

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●● 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Nokia N95 8GB

More often than not, manufacturers of converged devices sacrifice the quality of one feature for the functionality of another. The Nokia N95 8GB is an exception to this norm. It's a terrific phone with a high-resolution camera. In my tests, pictures with the 5MP camera looked great, though some shooting conditions, such as well-lit areas, are definitely much better than others due to the camera's limited modes and settings.

Running on Symbian S60 3rd Edition, the N95 8GB can manage your calendar, contacts, and email, and synchronize that data with your PC. It can also help you navigate the streets of an unfamiliar city, thanks to its integrated A-GPS (Assisted GPS) receiver and Nokia Maps. When available, A-GPS uses a data connection

to help calculate the coordinates of your location. The N95 8GB occasionally took a little while to grab a GPS signal. Once it did, navigating with Nokia Maps worked well. When I took a wrong turn, the software quickly recovered with a new set of spoken instructions (no text to speech, though).

As you would expect from its name, the N95 8GB has 8GB of storage capacity. This gives you the ability to store up to 20 hours of video or as many as 6,000 songs on the phone's internal storage. In my tests, video and audio quality was on par with other multimedia devices I've tested.



The N95 8GB's downfall is its hefty price tag. At the time of this writing, the phone was only available through Nokia stores, which means it's an unlocked phone and doesn't come with any carrier discounts. Still, if you combine the money you'd spend for an MP3 player, digital camera, and cell phone, I think you'd quickly find that \$750 isn't so bad.

Plus, who wants to carry three devices when one will do the trick as well as the N95 8GB? ▲

by Jennifer Johnson

N95 8GB
\$750
Nokia
www.nokia.com
● ● ● ● ●

Specs: 4.55 ounces; 3.9 x 2.09 x 0.83 inches (HxWxD); 802.11 b/g; A-GPS; Bluetooth with A2DP; 2.8-inch QVGA display with ambient light detector; 8GB internal flash memory; WCDMA (850/1900MHz); EGSM (850/900/1800/1900MHz); 5MP camera; stereo FM radio

Monsoon Multimedia Hava Titanium HD Wi-Fi

Thanks to DVRs, we can watch our favorite TV shows whenever we want, so long as we're at home. The Hava Titanium HD Wi-Fi claims to give us even greater functionality by letting us watch TV wherever we want, thanks to the device's ability to broadcast our local television over the Internet to any connected PC, whether at home or away from home.

The Hava Titanium HD Wi-Fi is a great idea in concept, but sadly, the implementation is lacking. For starters, setup wasn't very easy. After having a hard time making the system work with

my DVR because my exact model wasn't supported (a very similar model was), I gave up, dug out an old VCR, and connected it and the Hava box to a cable outlet apart from my home theater.

My problems didn't end there. Video quality was poor and jerky when broadcasting from the Hava box over my home's 802.11g wireless network. Although I expected a bit of a delay, the on-screen remote took longer than I expected (about five seconds to change the channel).

Thankfully, I had a much better experience

once I connected the Hava Titanium HD Wi-Fi via Ethernet. Although the picture was still a tiny bit blocky, it was feasible to watch TV on my wirelessly connected PC in a different room. Remote viewing was doable, as well, though the picture was a bit pixilated. I haven't tested the Slingbox, but a colleague thought the remote picture was as good, if not better than the Slingbox's picture.

Although the Hava Titanium HD Wi-Fi has some glitches, the device has potential for the right user. Some of the upcoming features, such as the ability to upgrade to an 802.11n dongle or support for an external USB hard drive (likely via a firmware update), are definitely compelling, as well. ▲

by Jennifer Johnson

Hava Titanium HD Wi-Fi
\$249.99
Monsoon Multimedia
www.myHava.com
● ● ●



Specs: Video inputs: composite, S-Video, component; hardware MPEG encoder; Ethernet; 802.11g wireless dongle; two USB 2.0 ports; IR emitter; Windows Media Center support; simultaneous remote and local viewing capabilities

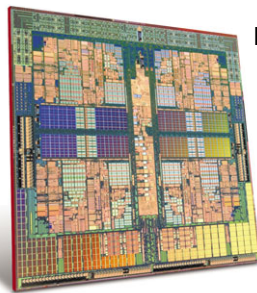
CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ● ● ● 2.5 = ABSOLUTELY AVERAGE | ● ● ● ● ● 5 = ABSOLUTELY PERFECT

AMD Phenom X3 8750

Although PC enthusiasts generally clamor for the fastest, most powerful processor, AMD is attempting to satisfy a different group of computer users with the Phenom X3 8750 triple core processor. The 8750 (and its 8650 and 8450 brethren) are designed to be the basis for multicore systems that can be built for under \$500.

You can do the math: a multicore 8750 for \$195, an AMD 780G-series motherboard for about \$100, and plenty of scratch left over for a decent graphics card (or two?) and a handful of other upgrades.

A sub-\$500 system is an interesting idea, but can such a budget-friendly processor



Phenom X3 8750

\$195

AMD

www.amd.com



pull its weight? The short answer is yes. Although the 8750 didn't blow anybody's

socks off in benchmark testing, its scores are certainly nothing to sneeze at. And when you consider the price-for-performance you get from this processor, it starts looking like an awfully good deal.

If you're looking for the Next Big Thing in performance, the X3 8750 is not for you. If, however, you're one of the millions of computer users who want a machine that is fast and powerful enough to knock out

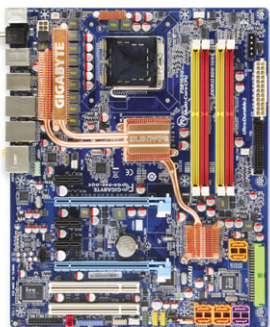
Test system specs: Gigabyte GA-MA790FX-DQ6; 2GB Super Talent DDR2 (dual-channel); Nvidia GeForce 8800 GT, 80GB Seagate Barracuda 7200.7

Specs: Socket AM2+; Clock speed: 2.4GHz; HyperTransport Link: 3.6GHz (full duplex); 65nm process; 95W max TDP

Gigabyte GA-X48T-DQ6

The Gigabyte GA-X48T-DQ6 is the latest in the company's line of solid, feature-packed, high-end motherboards. Running the X48 chipset, Intel's latest and greatest, there is a more than adequate number of I/O connections, and the board sports a number of built-in functions to make BIOS tweaking and overclocking easier.

The board includes Gigabyte's DES (Dynamic Energy Saver) technology, which lets you throttle power to save energy (so you can do your part for the environment between gaming sessions), as well as EasyTune 5 to adjust processor speed and clock voltage. Both functions can be tweaked and monitored through a



GA-X48T-DQ6

\$330

Gigabyte

www.gigabyte.com.tw



user-friendly interface, and DES pops up whenever you boot the computer. (You can disable this by right-clicking its System Tray icon.)

The most significant feature of the GA-X48T-DQ6 is its support for DDR3 memory up to 1,900MHz; its sister motherboard, the GA-X48-DQ6, only supports up to 1,200MHz DDR2. The DDR3 enhancement only serves to boost the performance of what was already a fine mobo.

With power-saving options, yet plenty of muscle, the X48T is a good choice for

Test system specs: 3GHz Intel Core 2 Extreme X9650, 3GHz; 2GB Kingston HyperX DDR3; HIS ATI Radeon HD 3650, 150GB Western Digital Raptor 1500

Specs: Socket 775; Chipset: Intel X48 Express; 1,600MHz FSB; Max memory: 8GB (DDR3-1900); Audio: Realtek ALC889A; Slots: 2 PCI-E x16, 3 PCI-E x1, 2 PCI; Ports: 10 USB 2.0, 3 FireWire, 2 Gigabit Ethernet

virtually any normal computing task at a rock-bottom price, this triple-core thing is probably right up your alley. ▲

by Seth Colaner

AMD Phenom X3 8750

3DMark Vantage

Overall	P4320/E12027
GPU	3961/18485
CPU	5931/5872

PCMark Vantage Pro

Overall	3723
Memories	2454
TV And Movies	2916
Gaming	3762
Music	3286
Communications	3310
Productivity	3881
HDD	2602
Dr. DivX 2.0.1*	7:38
WinRAR 3.71*	3:22

Cinebench 10*

Multithreaded (min:sec)	2:31
Multithreaded (score)	5820
POV-Ray 3.7 Beta**	1232.42pps
* minutes:seconds	
** pixels per second	

anyone who wants a high-end board with green considerations. ▲

by Seth Colaner

Gigabyte GA-X48T-DQ6

3DMark Vantage

Overall	P1214/E7062
GPU	936/6292
CPU	11164/11157

PCMark Vantage Pro

Overall	5266
Memories	3262
TV And Movies	4090
Gaming	4240
Music	4996
Communications	4725
Productivity	4954
HDD	4210
Dr. DivX 2.0.1*	4:40
WinRAR 3.71*	2:05

Cinebench 10*

Multithreaded (min:sec)	1:24
Multithreaded (score)	10473
POV-Ray 3.7 Beta**	1607.06pps
Crysis 1.1	
1,280 x 1,024, Low quality	56.92fps
* minutes:seconds	
** pixels per second	

Samsung T220 vs. ViewSonic VP2250wb

The Samsung SyncMaster T220 and the ViewSonic VP2250wb are geared toward two types of users, and that's very apparent in the performance and price of each. The ViewSonic was designed for professional use and had superior quality vs. the Samsung, which only brought a few gimmicky presets to the table.

The SyncMaster has more to offer in terms of visual appeal, with its elegant, rose-black plastic frame. The power switch is touch-sensitive, which helps it keep its sleek, glossy look. The biggest downfall of the SyncMaster was the placement of the five control buttons on the side of the frame. Without swivel capabilities, it was a real pain to make adjustments on the SyncMaster. I was either hitting the wrong buttons constantly or turning the monitor every second to find the correct setting.

The ViewSonic may not be as good-looking as the SyncMaster, but all the buttons are in plain view on the front of the frame. The ViewSonic, with its plain-Jane appearance, was more user-friendly. Additionally, the ViewSonic has a



wall-mount interface; detachable base; and pivot, height, tilt, and 120-degree swivel adjustments.

I ran both monitors through DisplayMate and S.T.A.L.K.E.R. as benchmarks and watched "X-Men: The Last Stand" on Blu-ray.

I focused on the SyncMaster's advanced control settings in DisplayMate. The MagicColor

SyncMaster T220

\$359

Samsung

www.samsung.com



settings include Full and Intelligent, which is

designed to tweak the color settings to make colors richer and brighter.

In addition to the SyncMaster's MagicColor settings, there are also MagicBright settings, which give you seven predefined brightness and contrast settings (Text, Internet, Movie, Sports, Game, Dynamic, and Customized). The Text and Internet settings weren't very useful because I had to fight through the five buttons on the side just to slightly tweak how the monitor displayed text documents and Internet browsers.

The skin tones looked very natural, and the colors were vivid but not too bright using the Movie setting with "X-Men: The Last Stand." The Game setting made S.T.A.L.K.E.R. appear

VP2250wb

\$559

ViewSonic

www.viewsonic.com



brighter, while the Dynamic setting was almost too bright and somewhat washed out. Finally, the Sports setting distorted the color quite a bit; like the Internet and Text settings, it didn't seem very practical.

The ViewSonic has 106% NTSC color technology, which is designed to boost the color saturation to 106% of the NTSC color gamut. It made a big difference in differentiating the color quality and

accuracy of the two monitors. The ViewSonic had a few predefined settings, such as ViewMatch color adjustments and Dynamic Contrast. The PerfectSuite Plus control software made a huge difference in the brilliance of the colors and images displayed by ViewSonic. I was especially im-

pressed with the color and skin tones while watching "X-Men" on the ViewSonic. The display produced very accurate colors on both "X-Men" and S.T.A.L.K.E.R.

I compared the color quality of the two monitors with DisplayMate and found that the SyncMaster couldn't match the quality or accuracy of the ViewSonic, even with the Full and Intelligent MagicColor settings on. When I tested the MagicBright settings, the black levels and the white saturation on the SyncMaster were good, but didn't fare as well as the ViewSonic's black levels and white saturation. Even when I customized the settings for the SyncMaster, it couldn't keep up. ViewSonic was able to produce a very true black.

Both monitors were very good at things such as viewing angle and glare reduction. And although the SyncMaster had more to offer in terms of looks and predefined settings, it was much more of a pain to use. The ViewSonic performed much better in all areas, without me pushing several wrong buttons to get it there. ▲

by Tessa Warner Breneman

Samsung SyncMaster T220 Specs: Resolution: 1,680 x 1,050; Brightness: 300cd/m²; Contrast ratio: 1,000:1; Viewing angle (degrees) 170/160 (CR>10); Response time: 2ms; Inputs: 15-pin D-Sub, DVI-D; HDCP-compliant

ViewSonic VP2250wb Specs: Resolution 1,680 x 1,050; Brightness: 300 cd/m²; Contrast ratio: 1,000:1; Response time 2ms (gray-to-gray), 5ms (black-white-black); Inputs: 15-pin mini D-Sub, DVI-D; HDCP-compliant

Integrated Graphics Get Serious

It's been a busy spring for the chipset industry, so I thought I'd talk about what's going on in the platform space this month.

AMD launched its 780G chipset, and it's quite possibly the best thing to come out of the ATI acquisition yet. Not only is the 780G the fastest integrated graphics chipset on the market today (faster than both Nvidia's GeForce 8200 and Intel's G35), but boards based on the chipset are also quite mature. I've been using the Gigabyte GA-MA78GM-S2H for a couple of months, and it's been absolutely wonderful. Honestly, the biggest issue I have with the 780G right now is that it doesn't support 8-channel LPCM (linear pulse code modulated) audio over HDMI, something that both GeForce 8200 and G35 do. If you can get around that, however, the 780G is great for an HTPC or any other AMD-based system. The performance of the chipset is within striking distance of the more expensive AMD 790FX and it has integrated graphics. If you're building any sort of AMD-based machine, I'd say this is the platform to get right now.

I've spent much of the past month playing around with Nvidia's nForce 780a SLI, Nvidia's latest AMD Socket AM2+ chipset. The 780a is the successor to previous ultra high-end Nvidia chipsets like the 680a and 590 SLI, but it does have a few new tricks up its sleeve. Starting now, all new Nvidia chipsets will ship with integrated graphics, and they all happen to have the same 500MHz mGPU that is in the GeForce 8200-based motherboards. I mentioned that this chipset is slower than AMD's 780G, but it's considerably faster than Intel's G35.

Why bother with integrated graphics on a high-end SLI chipset? With the 780a SLI, Nvidia has finally enabled HybridPower, which lets you turn off your discrete graphics card and use the chipset's integrated graphics when you don't need the added performance. Currently, you have to make the switch manually by using a little utility that sits in the Systray to select what mode you want to run, but it's a very useful technology.

It used to be the case that if you wanted a silent PC, you had to pick the fastest graphics card that could be passively cooled. Now, you have the ability to build a system with a GeForce 9800 GTX or GX2 (the only two cards that currently support HybridPower) and simply turn off the graphics card when you're not using it. When watching a movie (the integrated graphics core on all 2008 Nvidia chipsets fully supports H.264/VC-1/MPEG-2

decode acceleration), writing emails, or surfing the Web, your system is as silent as it can be and consumes less power, thanks to the discrete GPU being turned off. When you're playing a game, simply turn the GPU back on (two clicks is all it takes) and you have a high-performance system once again.

But there are some limitations to the technology. The motherboard's integrated graphics handle all display output, so you have to connect your monitor to the motherboard's VGA/DVI/HDMI connector. The integrated GPU only supports single-link DVI, so you're limited to a maximum resolution of 1,920 x 1,200. Secondly, you need a supported chipset, which thankfully is all of Nvidia's 2008 lineup (780a/750a/730a/8300/8200/8100). But you also need a supported GPU, which, at this point, is only the GeForce 9800 GTX or GX2. In some cases, you may have to close applications in order for the driver to be able to switch between the GPUs.

Needless to say, HybridPower is a very cool technology, and we expect to see something similar from AMD in the coming months. The downside to both AMD and Nvidia enabling these technologies is that you will almost certainly have to pair your GPU with your chipset when you build your next system; HybridPower only works with Nvidia GPUs and Nvidia chipsets, and I suspect the same will be true for AMD's version. As for what Intel is going to do to compete with this feature, I'm not quite sure yet. ▲



Anand Lal Shimpi has turned a fledgling personal page on GeoCities.com into one of the world's most visited and trusted PC hardware sites. Anand started his site in 1997 at just 14 years old and has since been featured in USA Today, CBS' "48 Hours," and Fortune. His site—www.anandtech.com—receives more than 55 million page views and is read by more than 2 million readers per month.

Talk back to Anand at anand@cpumag.com

The Shark Tank

by Alex "Sharky" Ross

Futuremark's 3DMark Vantage Arrives

Yours truly and any other press folks have long been using synthetic benchmarks for theoretical tests. They're controversial and not very applicable in the "real" world of PC gaming. I think we can all agree that if we want to find out how well a specific game performs, it's best to actually test the game itself. But as the years have gone by, Futuremark, the entity responsible for the 3DMark suite of tests, has always pushed the envelope in terms of 3D graphics with techniques and methods not yet found in existing games. I've always felt that using its tests gives you some type of indication of your hardware's capability in future titles, if you will.

Futuremark's newest suite, recently released, is called "Futuremark 3DMark Vantage" and is quite different from previous releases. If you're running a version of Windows XP and DX9, you might as well cancel the download and take out your frustrations with Grand Theft Auto IV on a PS3. 3DMark Vantage runs solely on Windows Vista and harbors specific DX10 tests only found with everyone's least favorite OS. In order to even be able to run this suite of tests, you'll need some very beefy hardware in order to meet the minimum requirements. Anyone with anything less than an Intel Core 2 Duo E6600 or Athlon 64 X2 6000 SSE2-capable processor and 2GB of RAM may also leave the room at this point.

Once the suite's installed, you'll be greeted with a much-improved interface and four "stock" benchmark scenarios to choose from. The Entry option turns off a lot of the complex features and runs at a paltry 1,024 x 768. Bump up to Performance and you're at what most of us feel is the equivalent of the "default" setting of the previous version of 3DMark. The Performance setting runs in 1,280 x 1,024 and allows you to choose your 3D settings. A High setting turns the knob up to 1,680 x 1,050. Finally, there's Extreme, which runs at 1,920 x 1,200 with much more detail and is designed to bring things to a crawl.

The new eye candy (Game Test 1) consists of four new tests, including "Jane Nash" who is escaping from a mad scientist and happens to be surrounded by some trick water effects, cascaded shadow maps (with PCF filtering), and plenty of dynamically skinned objects. Game Test 2 (New Calico) is also new and set in space with battleships and asteroids. This is a more complex test with moving objects using techniques such as variance shadow mapping, parallax occlusion mapping, and volumetric fog.

Two new CPU tests are also included in the suite. Test 1, an AI test (plenty of path-finding AI calculations here), shows an airplane race course with multiple pilots flying through gates while trying to avoid each other. The second test is more of the same, testing physics processing capabilities but with added complexity. 3DMark Vantage also has a suite of specific tests including texturing, parallax occlusion mapping, ray tracing, GPU cloth, and GPU particle, although they don't affect the overall score.

Futuremark is serving up various versions of 3DMark Vantage, including a free trial version that can only be run once on your system. If you like what you see, then there is a \$6.95 downloadable setup that allows you to run unlimited times using a single preset setting, or for \$19.95 you can unlock all the presets and custom settings (probably the one most of you would want to tinker with). Finally, for us press lackeys, there's the Pro Edition for \$495 that gives you full access. Futuremark has never actually released a proper "game," but there is some credence to synthetic benchmarks such as 3D Vantage. The ability to put your graphics card, CPU, and entire PC through its paces and then compare your results to other users via its nifty online results browser is almost worth the price of admission. ▲



Disrupting Reuters' newswire with a cheery Christmas greeting at age six, Alex "Sharky" Ross became an avid computer user/labuser, eventually founding popular hardware testing/review Web site SharkyExtreme.com. Exposing shoddy manufacturing practices and rubbish-spouting marketing weasels while championing innovative products, illuminating new technology, and pioneering real-world testing methods was just a front for playing with the best toys. The site acquired, he left in 2001. A London native and London School of Economics graduate, Alex currently overlocks/tunes Porsche 996 Turbos with www.sharkwerks.com when he's not tweaking PCs.

Email me at sharky@cpumag.com

PC Modder

Tips & Tutorials

Modding does the body good. A PC's body anyway, inside and out. Here you'll find hardware, firmware, tools, tips, and tutorials for modding your rig's performance and appearance. Send us your own mod-related tips and ideas at modding@cpumag.com.

Mods & Ends

NZXT Tempest

NZXT is well-known for its exotic-looking cases, some with equally as exotic-sounding names such as Apollo, Lexa, or Adamas. But with the recently released Tempest (\$99; www.nzxt.com), NZXT took a somewhat different approach. Instead of designing an aesthetically over-the-top chassis, NZXT focused on affordability and airflow with the Tempest. The case's six fans consist of dual 120mm intake, dual 140mm exhaust, and two additional 120mm fans on the rear and side panel, respectively. The combination of large fans with a perforated front bezel keeps air moving through the Tempest, which will keep internal components running cool.

The Tempest also features a windowed side panel; top-mounted USB, eSATA, and audio ports; and a predrilled motherboard tray that makes cable routing behind it a snap. NZXT caters to fans of liquid-cooling, as well, as the case can house a



NZXT's Tempest was designed with maximum airflow in mind.

radiator at the top and features cutouts to accommodate tubing through the rear.

Zalman FG1000

As if today's first-person shooters weren't realistic enough, Zalman has designed a mouse in the shape of a pistol grip that literally gives gamers the ability to pull the trigger on the enemy. The Zalman FG1000 (\$59.99; www.newegg.com) features a 2,000dpi tracking resolution with on-the-fly DPI control, an image processor capable of sampling 6,400 frames per second, and a fast 1KHz USB polling rate. It also sports five user-programmable buttons, a lighted scroll wheel, and a forward-mounted sensor. Unlike standard mice where the tracking sensor resides directly under the user's hand, the FG1000's sensor is situated under the front-most portion of the casing, ahead of the grip, which allows for a wider targeting angle with smaller hand movements.

Zalman lets you pull the trigger on the enemy (literally) with the FG1000 gaming mouse.



PrimoChill PC Ice

One of the major drawbacks of liquid-cooling is the potential for coolant leaks. Coolant leaks can not only be downright messy but also potentially cause short circuits and ruin an entire system. To help minimize the potential for leaks and



Don't worry about short circuits due to coolant leaks any longer, thanks to PrimoChill's Ice nonconductive liquid coolant.

eliminate the possibility of a short circuit, the good people at PrimoChill have released their PC Ice nonconductive coolant (\$15.95; www.primochill.com).

PrimoChill's Ice coolant (available in 32oz. quantities) is made from a non-electrically conductive liquid that is also food safe and biodegradable. PC Ice also has lubricating properties that help keep seals and gaskets pliable and increase pump life. It has corrosion-inhibiting ingredients to prevent sludge buildup and galvanic corrosion that's caused when different metals reside in the same coolant loop. PC Ice is available in a variety of colors, if you'd like to add some personality to your liquid-cooling setup.

Fashionably Fresh Firmware

MacBook Air EFI Firmware Update (v1.0)

Apple recently released an EFI firmware update for the MacBook Air that fixes several issues and improves system stability. The specific issues fixed were not listed.

www.apple.com/support/downloads

LaCie LaCinema Premier (v3.10)

A firmware update for the LaCie LaCinema Premier adds Polish and Greek language support and fixes a bug that prevented access to the Movies, Music, and Pictures folders using their respective remote control shortcut buttons.

www.lacie.com

Pioneer BDC-202 (v1.04)

An update for the Pioneer BDC-202 BD-ROM drive adds support for new Ritek 12X DVD-R and 4X DVD-R DL media and resolves a problem that could cause long boot times with certain unspecified hardware combinations.

www.pioneer.co.jp

by Marco Chiappetta

Eee PC Storage Mod

Add More Gigabytes In A Flash

When Asus first unveiled the Eee PC ultraportable notebook at Computex last year, it sparked a firestorm of interest from power users and budget-conscious mobile users alike. Power users were enamored by the Eee PC's unusually diminutive form factor, and portable PC enthusiasts dug the machine's silent operation, durable flash storage, and affordable price.

Although initially pitched as an alternative to the OLPC XO, the Eee PC had obvious appeal to a much larger audience. Asus capitalized on the interest by quickly releasing a slew of Eee PC models with different colors and storage options.

One common complaint about the Eee PC, however, was its relative lack of storage space. Initial offerings were equipped with only 2GB or 4GB of flash storage, and although it was plenty

of space for the system's customized Linux OS, it didn't leave much room for additional applications, media, and other large files. A simple solution was to connect a USB flash drive, but even an average-sized flash drive was about a third of the width of the entire Eee PC, somewhat defeating the purposes of the Eee PC's petite frame.

Almost immediately after its release, the modding community focused its attention on the Eee PC and came up with a number of slick mods. Because storage was such a common concern among Eee PC users, it was no surprise that many of the earliest mods aimed to remedy the situation.

Considering just how popular the Eee PC has become, we thought it would be fun to stray from our traditional desktop modding and show you how to complete one of the more useful storage mods for the Eee PC. In the end, you'll be able to

add as much storage as a USB flash drive will allow, and gawkers won't even know it's there.

In The Beginning

To add some stealthy additional storage to an Eee PC, you'll need a standard USB flash drive, a USB extension cable, and a number of tools. A small, Phillips screwdriver is necessary to disassemble the system, and you'll also need a soldering iron, wire strippers, some electrical tape, a multimeter, and a sharp razor blade. We used a PNY Attaché flash drive for our project, but any drive that can be disassembled, is less than .35-inch thick, and less than 2.45 inches long can be used (which is most drives on the market).

Before you attempt this mod, we have to make the standard disclaimer: Because the Eee PC must be almost completely disassembled and the mod requires soldering some new wires to an internal connector on the motherboard, the machine's warranty will certainly be voided. Also, be aware that if your soldering skills are not up to par, you could damage the Eee PC's motherboard irreparably and ultimately kill the machine. Finally, the USB port to which the wires were soldered cannot be used when the flash drive is plugged into the new internal connector. So, cover up the external port after you've finished the mod. With all that said, this mod is actually relatively easy to complete if you have the courage to attempt it.

Rip Everything Apart

The first step to this mod is to disassemble the Eee PC. (We used a 700 series Eee PC.) There are a multitude of screws that need to be removed and the quarters can be tight, but the process is more



We started this mod with a stock Asus Eee PC 701, a run-of-the-mill USB flash drive, and a standard USB extension cable.



Taking the Eee PC apart to gain access to the necessary solder points and to run the wires needed for the mod is the most time-consuming part of the mod. There are a multitude of screws that need to be removed and snap points that need to be disengaged. Once the Eee PC is apart, making the required connections is actually pretty easy if you know your way around a soldering iron.

tedious than difficult. Asus made a good design decision with the Eee PC screws: Every screw that needs to be removed is the same size and color, so there's no need to worry about marking the screws' locations to remember where they go.

Start the disassembly process by flipping the Eee PC over and removing its battery. Then, using the Phillips screwdriver, remove the two screws holding the cover plate at the center in place; then remove the other six screws around the perimeter. With the cover plate removed, you can see the cavity where we'll be installing the additional flash storage.

Once you've removed all of the screws from the underside of the device, flip the machine back over and open the display as far as it will go. You'll see three tiny metal clips protruding from the following locations: above and between the "~" and F1 keys, above the F6 key, and above the PAUSE/BREAK key. Using the razor blade (or a small flathead screwdriver), carefully push the metal clips inward. Start from one side, and you'll find that the keyboard will pop up slightly as each clip is disengaged. Once you've disengaged all, gently lift the keyboard up a fraction of an inch and slide it forward towards the screen. Underneath, you'll see a wide ribbon cable connected to the motherboard. Disengage the plastic retention clip on the connector holding the ribbon cable in place and simply slide the cable out of its connector. Be gentle

here, because the plastic clip is thin and rather delicate.

With the keyboard removed, you'll be staring at a plain-looking metal EMI shield, which doubles as a heat spreader for the system's processor and chipset. This EMI shield also has to be removed. Unscrew all of the screws visible around the edge and scattered about the center of the shield. Now the fun can really begin. With all of the screws removed, you can take off the entire top cover of the Eee PC, which includes all of the plastic around the top edges of the unit, the metal EMI shield, and the touchpad. Carefully lift the cover up, paying special attention to the edges. There are snapping clips around the entire perimeter of the plastic bezel, spaced about 2 inches apart. Once they are all disengaged, the top cover will essentially be free from the Eee PC, except for another tiny ribbon cable connecting the touchpad to the motherboard. Like the keyboard connector, you'll need to disengage the plastic retention clip on the connector holding the ribbon cable in place and simply slide the cable out.

Now, pat yourself on the back. You've completed all of the necessary steps to disassemble the Eee PC.

Make The Connections

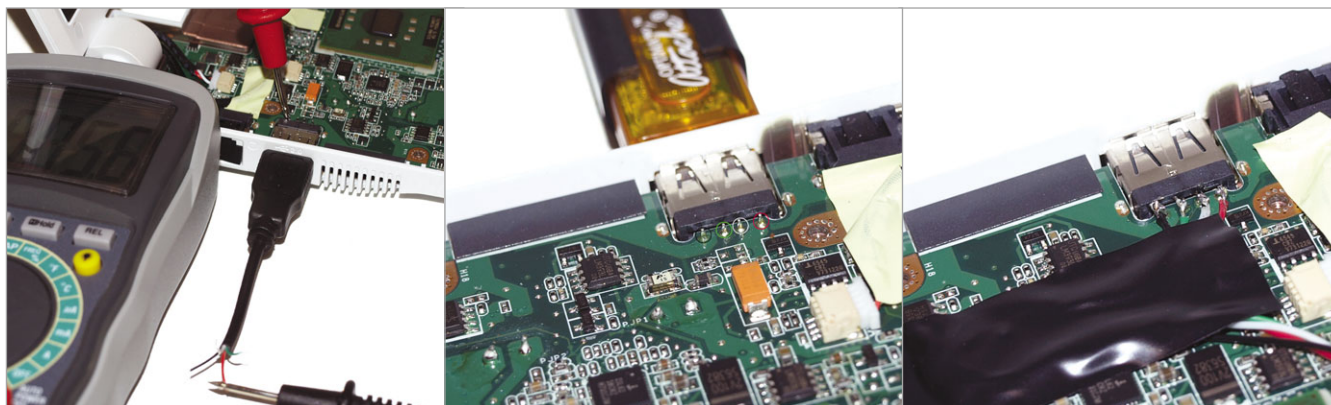
With the Eee PC's top cover removed, the motherboard will be fully exposed. To the left (the side with the

LAN, headphone, microphone, and single USB ports), you'll find four solder points just behind the USB port. You'll eventually connect a portion of the USB extension cable to these solder point, but before doing so, you need to know where each wire goes.

Cut off the male end (the side with the same type of flat connector as the flash drive) of the USB extension cable, leaving about 3 inches of the cable intact. Then, strip off about an inch of rubber sheathing and any visible metal foil shielding to expose the colored wires within. A standard USB extension cable has four wires: black, white, green, and red.

Strip a bit of rubber sheathing from the end of each wire and then plug the connector into the USB port. Fire up the multimeter and set it to check for continuity. Hold one lead from the multimeter on one of the colored wires, and then probe the four solder points on the motherboard until you find the point that corresponds to that colored wire. Repeat this step for each wire and you'll know where each color should be soldered. In our case (see photo), the sequence from left to right was black, green, white, and red.

Next up, prepare the half of the USB extension cable with the female connector for soldering into the Eee PC. Strip all of the rubber sheathing and metal foil shielding from the cable and cut the wires to about 7 to 9 inches in length.



There are four wires in a typical USB extension cable: black, white, green, and red. And each color corresponds to a particular solder point in the USB connector. To find out where to solder each wire, use a multimeter to check for continuity between each wire and the solder points in the connector.

Then, using the razor blade, shave the top, bottom, and sides of the connector down to bare metal. The connector is too thick in its stock form to fit in the compartment on the underside of the Eee PC, which is why it must be shaved down. Hold onto the rubber that gets shaved from the connector, though; you'll need to use that later.

Once you've cut down and prepped the female end of the USB extension cable, it needs to be fed into the Eee PC with the wires routed from the underside to the top of the motherboard. If you flip the Eee PC over and look through the battery connector, you'll see a small area to one side where you can pass the wires through and route them over the top. Before routing them through this hole, take a few strips of electrical tape and cover all of the exposed areas of the PCB visible in the open compartment on the underside of the Eee PC. This is a precautionary measure meant to

prevent any short circuits once the flash drive and USB extension cable are in place. Then, stick the female end of the USB extension cable into the right side of the compartment and route the wires through to the top side of the motherboard.

Once the wires are in place, solder each one to its corresponding solder point. Take your time here and use a clean soldering iron with a sharp tip. Be careful to touch the hot soldering iron tip to only the metal post exposed behind the connector for only a few seconds at a time. Use as little solder as possible to make a good connection.

Finally, if your flash drive doesn't fit in the underside compartment of the Eee PC, disassemble it until just the PCB and connector remain. This process will differ between flash drives but usually doesn't take more than snapping apart a plastic enclosure or peeling away some protective rubber.

Your Eee PC: Now With More Storage

After soldering the wires in place, you can reassemble the Eee PC. Route the newly soldered wires out of the way of the system's processor and chipset and use a bit of electrical tape to hold them in place. Then put the Eee PC's top cover and EMI shield back in place and reconnect the ribbon cable for the touchpad. Replace all of the screws removed during disassembly, reconnect the keyboard, and then snap the keyboard back in place.

Now flip the machine over and replace the six screws around the perimeter. Plug the disassembled flash drive into the female USB port that now resides in the compartment on the unit's underside, tuck everything in neatly, and replace the cover over the compartment.

If all went well, the next time you fire up your Eee PC, the flash drive will be available as if it were plugged into a USB port. But we're not quite done yet.

To cover the now-useless external USB port, we used a piece of the rubber that was shaved from extension cable and cut it to fit the port, but a piece of tape will do. Should you accidentally plug something into the port while the flash drive is also being used, you'll have to power the system down, and remove the battery for a few moments to reset the circuit. ▲

by Marco Chiappetta



With the mod complete, the wires we soldered to the USB connector are visible in the Eee PC's battery compartment. The flash drive and port we added are nicely hidden under an access panel, however. To prevent the use of the modded USB port, we fashioned a rubber plug from the leftover connector on the USB extension cable.

Mad Reader *MOD*

Revisiting City 17

Say you're a young guy who's just taken up an interest in case modding, you have a black Chieftec case you're tired of looking at, and you have full access to your school's shop equipment. What would you do? Mario Mayer (a.k.a. [maRiio]), this month's featured modder, knew exactly what to do. He started cutting, modding his PC to honor one of the best and most popular videogames of the past several years.

Mario got into the habit of visiting PC modder sites and soon became fascinated with some of the amazing projects he saw online. He was inspired to try his hand at modding and chose *Half-Life 2* as his theme. Mario, who enjoys design and technical drawings, used the milling and drilling equipment in his school's shop to work on his PC project.

Most of the work focused on the Chieftec CS-601 case, which Mario painted a base gray color. He found some "rusty paint," which includes real iron that, when treated with an oxidizing solution, would actually turn to rust. Mario applied generous amounts of the paint to his case, giving it the gray/rust color combo that's so pervasive in the world of *HL2*.

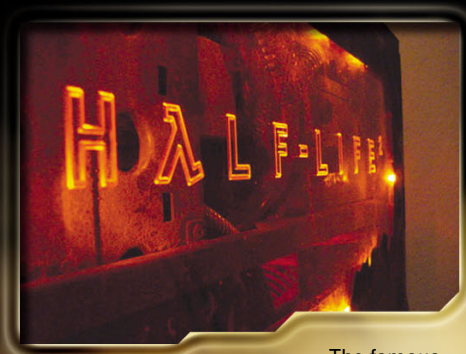
Mario added Plexiglas to both sides of the case, as well as the front. On one side, Mario included a *Half-Life 2* logo; he put the famous Lambda symbol on the front of the system. Mario also included a VL System L.I.S. 2 Premium VFD display in one of the front drive bays, with which he can monitor the PC's temperature, control the fans, display the time, or even display an equalizer for Winamp or Windows Media Player. Mario intentionally broke the Plexiglas on the other side of the case using a Dremel to give it more of a roughed up look.

The system is based on an Asus P5W DH Deluxe motherboard with an Intel Core 2 Duo E6600 CPU, 2GB of RAM, and a GeForce 7950 GX2 video card. The PC also has a watercooling system, of course, which includes a 240mm radiator and orange UV tubes fit with UV LEDs. (The logos on the side of the case are lit by orange LEDs.) Mario stuffed the computer's cables into electrical tubing to keep the inside of the case nice and tidy.

We think Mario's case turned out very well (especially for his first attempt at modding), and this won't be his only modding project. Mario says he's already hard at work on his next mod, which he says will have a futuristic look. ▲



by Michael Sweet



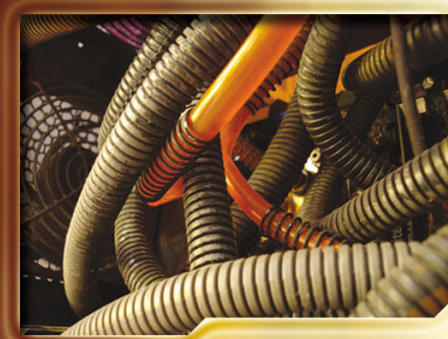
The famous Half-Life 2 logo, backlit ominously with an orange glow.



Mario uses the VFD he installed to check the fans on his system, among other things.



Mario busted the Plexiglas on one side of the case to give his PC that "City 17" feel.



All of the case's internal wiring is tucked away into several tubes.



A switchbox (which Mario built) on the front of the system controls the case's lighting.

Mad Reader Mod Newsflash

CPU and *NVIDIA* are proud to announce the very first Ultimate Case Mod Challenge, to be held at *NVISION* '08 August 25-27 at the San Jose Convention Center!

CPU magazine is taking Mad Reader Mod on the road to one of the country's premiere LAN events and offering you a shot at \$5,000 in cash (plus some insanely cool prizes) and a chance to get your mod on the cover of a *CPU* issue.

Rules:

1. One entry per person (not per seat).
2. Mods that have previously been published in print are ineligible.
3. Judges' decisions are final and are based on the following criteria:
 - Technical merit: Creative placement of parts and "outside-the-box" changes you have made to existing components or your case that are likely to have a positive effect on performance.
 - Artistic merit: Does the case have a cohesive theme or a distinctive look, or is it simply a collection of parts thrown together behind a window and lighted fans?
 - Polish: The fit-and-finish portion of your work. This includes clean, smooth paint; solid cable management; tight, smooth seams; the functionality of your mods (i.e. custom doors and mechanisms); and effective use of lighting.
 - "Wow" factor: The judges' overall reaction to your mod.

And the deal gets sweeter: *NVIDIA* will offer the winners of our Mad Reader Mod feature from this issue through the event a free trip to *NVISION* '08, including airfare, hotel, and event admission! (Certain limitations may apply, see *NVIDIA*'s event Web site for full contest info.) So enter your mod at madreadermud@cpumag.com and check www.nvision2008.com/enthusiasts/geforce-lan.cfm for more information.

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“ As you can see, things start to get pricey as you move up in the chipset family. ”

Each month, we dig deep into the mailbag here at CPU in an effort to answer your most pressing technical questions. Want some advice on your next purchase or upgrade? Have a ghost in your machine? Are BSODs making your life miserable? CPU's "Advanced Q&A Corner" is here for you.

Hallet R. asked: The last time I bought a power supply (a Corsair 550-watt unit), one of the features touted was a single 12V rail rated at 41A. The previous four or five power supply units I purchased before that one, from various manufacturers, bragged about having dual 12V rails delivering about 12 to 18A or so each. What is meant by dual or single rail? Exactly how is the load distributed across the dual rails? Do you draw from each equally? If you have a hypothetical load of 24 amps, will it draw 12A from each or 18A from one and 6A from the other? If the CPU manufacturer recommends +12V to be at 18A minimum, would dual rails at 15A be sufficient? Would this deliver approximately 30A for 12V needs, or is it split so no one load can exceed 15A? Why is it I see a return of the single-rail power supplies?

I usually buy middle-of-the-road power supplies and generally have good results. The machines in question don't run games, do any graphics work, or require multiple drives. They do need powerful processors, though, and as much RAM as possible. The Corsair unit seemed a good choice for my needs, but the single-rail/dual-rail issue has me stumped. Thank you in advance.



Many enthusiast power supplies feature a single high-output 12V rail, as opposed to multiple lower-output rails.

A: First of all, if you haven't done so, please take a gander at the May 2007 issue of *CPU* (Vol.7 Issue 5, pages 60 to 65). In the article titled, "The Principles Of Power: Get Your Ph.D. In PSUs," we answer all of your questions and then some in great detail and review a number of quality power supply units.

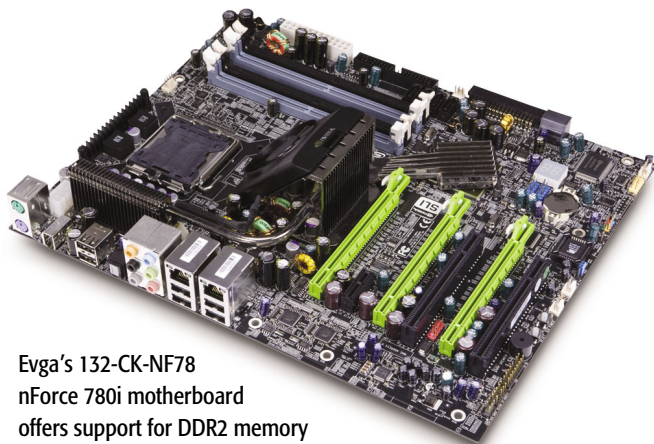
To briefly summarize what we explained in that article, multirail power supplies differ from single-rail units in that their 12V feeds are broken up into multiple lower-output feeds—or rails—instead of one large, high-power rail. The load

is distributed across the rails by connecting different devices to the various leads coming from the PSU. For example, the PCI Express power leads coming from the PSU may use one rail, while the 4-pin Molex peripheral connectors use another. And the maximum output capability of each of the rails will vary from PSU to PSU, hence the different maximum power delivery ratings you mention. If the maximum capacity of any rail is exceeded, even if there is still plenty of headroom left on another rail, the PSU will typically shut down or, worse, fail. This is actually one of the major drawbacks to a multirail PSU.

In a single-rail design, 100% of the PSU's output can be supplied to a system, because every component draws its power from a single source. In a multirail design, however, different components may draw power from different rails, and the load is not shared across the rails. So, to answer your question about the hypothetical 24A load, if the PSU rail powering the load cannot supply 24A, the PSU will fail or enter a protected mode, even if one of its other rails is being underutilized.

Ian P. asked: Even though my motherboard is rather new, I want to go SLI in the future, maybe even quad-SLI with dual GPU cards eventually. What would be a good motherboard choice that isn't crazy expensive, supports SLI and Intel processors, and has enough room for the latest powerful Nvidia cards? I know this limits me to Nvidia chipsets only, but there are a lot of flavors in the nForce family. Again, I don't need the absolute top-of-the-line motherboard but just something capable today with the ability to scale in the future.

A: You have a number of options here, Ian, but it depends on whether or not you'd like to preserve an investment you may have already made in your system memory. It also depends on how "future-proof" you want your system to be and the cost factors associated with the upgrade. If you decide you want to save on system memory and reuse your DDR2 memory, then we'd suggest going with a motherboard built on the nForce 680i or nForce 780i family of chipsets. If getting the latest and greatest technology from Nvidia for a multi-GPU system is important, then a new nForce 790i-based motherboard with DDR3 memory



Evga's 132-CK-NF78 nForce 780i motherboard offers support for DDR2 memory Intel processors up to a 1,333MHz front side bus, if you're not ready to make the jump to DDR3 yet.

is probably the way to go. All of these chipsets also support up to 3 way or quad-SLI graphics with three available full-length x16 PCI-E slots available, depending on the specific motherboards you're considering. The major differences between the 680i and 780i are higher front side bus support and support for PCI-E graphics on the 780i.

In terms of 680i motherboards, Evga's 122-CK-NF68-T1 is a great option at around \$169, but they're getting harder to find these days. MSI's P6N Diamond is another good nForce 680i choice. For 780i boards, we like Evga's 132-CK-NF78-A1 for around \$249. As you can see, things start to get pricey as you move up in the chipset family.

Finally, though not nearly as practical from a price standpoint these days, due to the fact that only "Ultra" version 790i chipset boards seem to be on the market currently, we'd recommend the XFX MBN790IUL9 motherboard at around \$347. But remember, you'll need to upgrade to DDR3 memory, as well. Asus also has its killer Striker II Extreme 790i motherboard, with integrated chipset waterblock cooling, but at \$449, that's starting to get "crazy expensive," as you say. Decisions, decisions . . . good luck! ▲

by Dave Altavilla and Marco Chiappetta,
the experts over at HotHardware.com

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Ambient's The Audeo

Hear What You've Been Missing

Inventors often start with a goal in mind, a problem they want to solve that can improve lives. As they reach the initial goal, they sometimes find their technologies and inventions can expand into other areas, solving other problems.

Rarely, though, do inventors find themselves expanding into new areas even before the invention that reaches its initial goal becomes available for use. The inventors behind the Audeo are finding themselves in just that situation: working on a technology that would appear to have several usable applications beyond the original goal.

Giving People A Voice

The Audeo is a technology that reads nerve signals sent from the brain to vocal cords that—because of muscle diseases or paralysis—cannot generate speech. The

Audeo uses sensors, computer hardware, and computer software to translate the nerve signals from the brain into computer-generated speech, bypassing the vocal cords.

Michael Callahan, working with Thomas Coleman, began developing the Audeo as an undergraduate student at Illinois Urbana-Champaign in 2004, aiming the technology at providing speech to those who've lost the ability to speak because of diseases that affect muscle control, such as Lou Gehrig's disease (ALS). They founded Ambient Corporation in October 2005.

As they've developed the Audeo, though, they've found that the technology can do more than the original plan of helping ALS sufferers generate speech. Callahan and Coleman found that they could use the Audeo to give those who

cannot move or speak the ability to control a powered wheelchair, simply by thinking about saying certain commands.

And, more recently, Callahan demonstrated the ability to use the Audeo to make a cell phone call without speaking. For example, in the future, someone using a cell phone could use thoughts and the Audeo to generate the sounds for the conversation, without revealing the details of the conversation to nearby people.

Original Goal

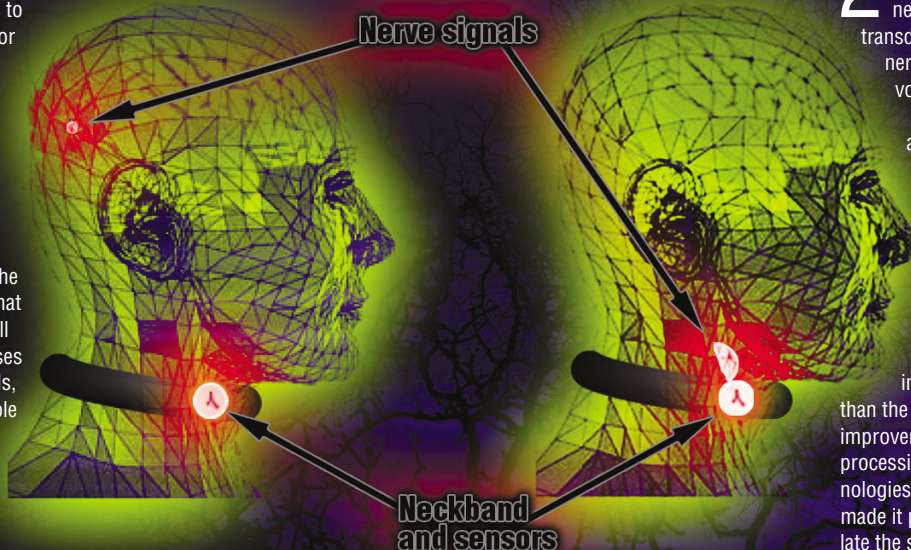
Development continues on Ambient's original goal for the Audeo: giving speech to those afflicted with disease and paralysis. The Audeo system Ambient demonstrated early in 2008 could recognize about 150 words and phrases. Around the end of 2008, an upgrade to the Audeo system

The Audeo At Work

When using the Audeo system, users need to have complete focus on the words they want to speak. Ambient's Callahan says you can think of using the Audeo system as one step below vocalizing but one step ahead of simple

thoughts. Users have to think about and want to speak the words; Ambient calls it an intent to communicate. The Audeo will not "read thoughts" unless the subject has a desire to speak. ▲

1 To create speech, the brain sends nerve signals to the vocal cords. For people with certain speech impairments, such as those caused by diseases such as ALS, though, the vocal cords don't work correctly. (The system requires that the person can still send nerve impulses to their vocal cords, but might be unable to speak because of a lack of muscle control.)



2 When someone wears Ambient's neckband, the neckband's sensors and transducers can measure the nerve signals aimed at the vocal cords.

This is a challenging aspect of the system because nerve signals are extremely small and difficult to pick up.

An EKG works on a similar principle, measuring the electrical impulses from a muscle as it contracts, but those impulses are much stronger than the nerve signals. Significant improvements in recent years in processing power, in sensor technologies, and in algorithms have made it possible to read and translate the small nerve signals.

should allow it to work around the 150-word limit by having the system read the units of sound used to form words in language, called phonemes. By putting together the units of sound, the system could conceivably generate almost any word.

The Audeo initially will be available in English only, although Ambient expects to offer the technology in multiple languages eventually. Callahan has compared the current advancement of the Audeo to the early days of speech recognition, with additional advancements occurring quickly in the next few years.

Inside the neckband, the Audeo is using the MSP430 microcontroller from Texas Instruments to digitize the nerve signals before sending them to the computer for analysis. The MSP430 requires very little power to operate, meaning the Audeo neckband can run for up to eight hours per battery charge.

"Ambient is at the forefront of innovative technology that will enable people to communicate in entirely new ways, whether helping give the gift of communication to someone who has lost the ability

to speak or allowing consumers to communicate voicelessly via cell phone in environments not conducive to conversation," says Texas Instruments Senior Vice President of Application Specific Products Mike Hames. Hames was involved in the cell phone demonstration of the Audeo at the TI Developer Conference early in 2008.

Ambient is working with the University of Illinois and the Rehabilitation Institute of Chicago to test the Audeo. National Instruments and the National Center for Supercomputing Applications are providing additional support.

Other Research

In 2004, NASA created a system that read nerve signals and slight muscle movements in the mouth and throat to determine a limited number of words. The subject would act as if he were saying the word silently, which would spark the muscle movements and nerve signals.

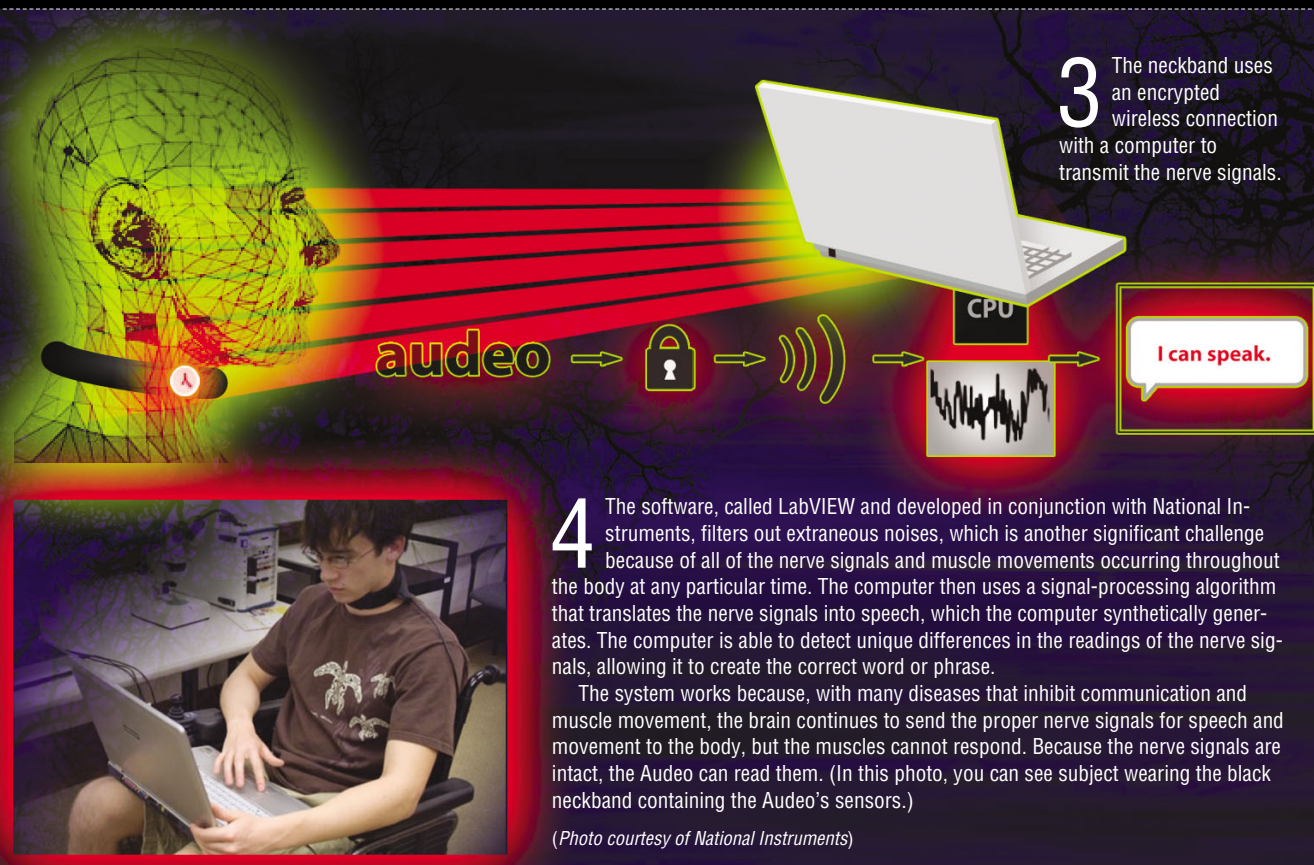
Cal-Berkeley researchers are using MRI readings to translate signals from particular

areas of the brain and determine the brain's actions. For example, the researchers showed people a series of photographs, using an MRI to measure the brain activity that each photograph sparked. Later, once the researchers had enough brain scan data, they were able to determine which photograph a person was viewing based solely on the MRI of the brain scan.

The Brain Computer Interface (BCI) group (with the New York State Department of Health) and Cambridge Consultants have been working on a sensor cap that measures electrical signals on the surface of the skull and translates them into computer commands, allowing severely paralyzed people to communicate.

At its current rate of development, though, the Audeo appears to have the best chance of becoming a workable option for ALS sufferers soon, all while causing minimal inconveniences for the user. Best of all, it already has a head start on reaching its secondary goals, as well. ▲

by Kyle Schurman



The Power Of A Tock

Intel's Nehalem Brings New Architecture

Normally, the tick-tock of a clock represents one second of time. But unless that second is

occurring as stock cars scream under the checkered flag at a NASCAR event or as sprinters lean for the finish line at the

100-meter dash in the Olympics, that single second alone usually isn't going to bring important, earth-shaking changes.

Nehalem's Cache Structure

Nehalem's cache system will be significantly different from the cache system found in previous chip designs, with the major changes found in the L2 and L3 caches.

Nehalem will introduce a new three-level subsystem for cache memory. This subsystem makes use of Intel's Smart Cache technology.

L1 The L1 cache will be the same as in previous designs, with a 32KB area for instruction (I-cache) and another 32KB area for data (D-cache).

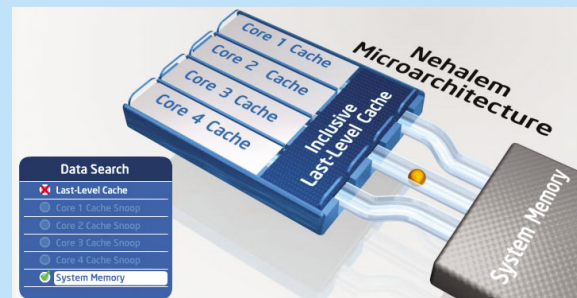
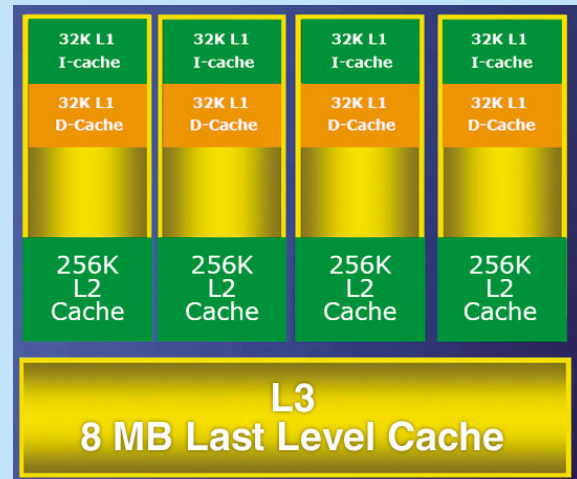
L2 The L2 cache becomes exclusive to a particular core under Nehalem, unlike with past Intel multicore chips. Each core's own L2 cache contains 256KB of memory. The L2 cache provides very low latency performance, and as the number of cores in the chip increases, the L2 cache becomes an important component for reducing pressure on the L3 cache.

L3 Finally, Nehalem contains a new, large L3 cache containing a varying amount of memory that all of the cores share. In a quad-core setup, as shown in this example, the L3 cache would contain 8MB of memory. The overall structure of the L3 cache makes it easily scalable to meet the needs of the chip.

"Penryn had two levels of cache hierarchy, instruction and data, and a second level that was shared," Intel's Singhal says. "There's three levels in Nehalem. The instruction and data caches are the same. We added a second level that's private to each core. With 256KB, it can hold both code and data. It's designed for low latency and high performance. . . . As we increase the number of cores, we don't run into problems with all of the cores trying to access the same memory areas as the others. With the L3 cache, as we increase the number of cores, we have the ability to increase the cache size."

When using a last-level cache that's exclusive to a core, the overall system can slow considerably when a miss occurs on the last-level cache. With a miss, the system then must search (or snoop) each core's cache. If the data is not in those cache areas, the system must eventually search system memory, which causes latency issues.

With an inclusive last-level cache, as is found with Nehalem, a miss on the last-level cache doesn't cause significant latency issues because the system knows the data is outside the processor in system memory and accesses the data there. The system no longer must snoop the cache areas of each core. ▲



Source: Intel

Intel, however, has found a way to make a tick-tock extremely important . . . and all the company had to do was stretch each tick and tock to one year in length.

Intel recently announced details of Nehalem, the *tock* in its new tick-tock microprocessor development schedule, where Intel introduces significant microprocessor improvements once per year. Nehalem offers plenty of new technologies in a 45nm manufacturing process.

Nehalem's Plans

With Nehalem, Intel can offer significant improvements in performance and with lower power consumption. Intel also has made the Nehalem core with the capability to scale to meet a variety of market segments. Intel says Nehalem will be its most scalable chip design.

IMC. Nehalem's IMC (integrated memory controller) will support DDR3-800, DDR3-1066, and DDR3-1333 memory, providing flexibility. The new microarchitecture's IMC greatly improves performance and offers a large amount of memory bandwidth.

Scalability. Intel can offer Nehalem with anywhere from two to eight cores, meaning

Intel's Smart Cache

Intel's Smart Cache technology optimizes performance and decreases latency with cache memory management and configuration designed specifically for multicore processors.

Intel introduced Smart Cache technology a couple of years ago, but it applies efficiently to the Nehalem architecture.

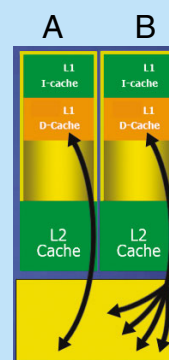
By sharing the L3 cache in this Nehalem architecture example, each core can easily access shared data from L3.

The shared L3 cache also optimizes the system resources. For example, Core A might have minimal requirements of its cache, while Core B might need a large amount of the available cache. If the L3 cache wasn't shared and each core was limited to an equal percentage of the cache, Core A would be wasting its cache allocation resources, while Core B would suffer poor performance because its cache allocation would be too full. With the Smart Cache technology, though, Core B can access as much of the L3 cache as it needs, as long as Core A doesn't need much. The overall system and cache resources are maximized. ▲



No sharing of L3 cache

In this example, Core B needs more L3 cache memory but cannot "borrow" from Core A's L3 cache area—even though Core A doesn't need all of its cache area—leaving Core B with performance problems.



Shared L3 with Smart Cache

In this example, Core A requires a minimal amount of L3 cache memory. Using Smart Cache technology, Core B can make use of as much free space in the shared L3 cache area as it needs, which allows Core B's performance levels to remain high.

Source: Intel

Simultaneous Multithreading

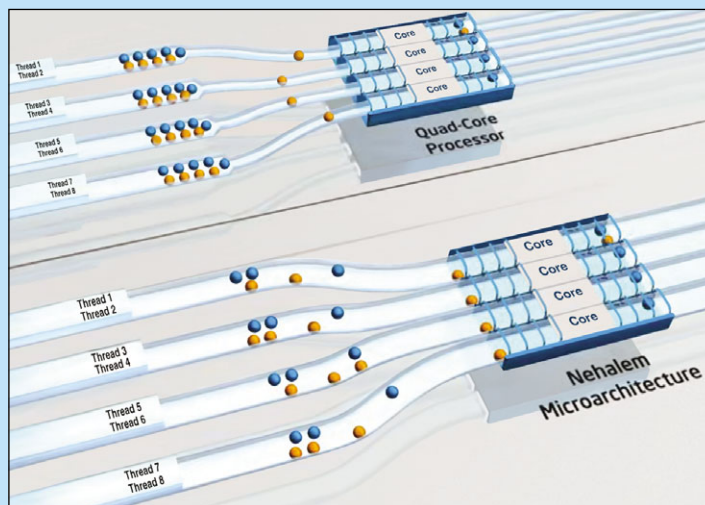
Intel offered the first desktop processor featuring SMT (simultaneous multithreading) in 2002 with the Pentium 4. Nehalem will continue Intel's work with SMT, but with improvements. Nehalem will offer the capability of up to 128 micro-ops (microprocessor operations or instructions) vs. the 96 micro-ops with Penryn (a 33% increase).

With SMT, each core can execute two threads simultaneously, doubling the number of threads that it can process vs. a processor without SMT. With Nehalem and its multiple cores, SMT becomes an even more valuable tool.

Multithreading provides several benefits, including:

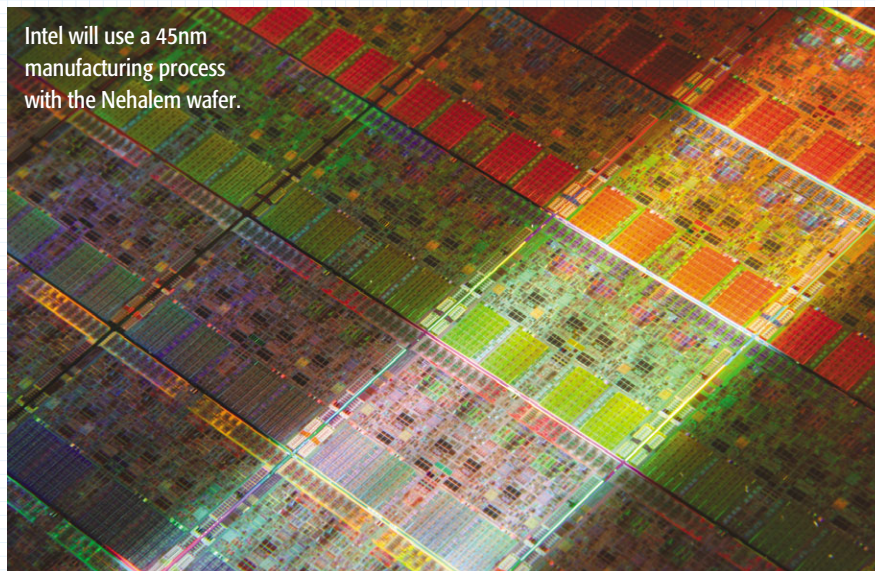
- Increased multitasking capabilities
- Increased performance out of applications that can take advantage of multithreading, such as multimedia, database searches, and search engines
- Improved power efficiency

Pentium 4 supported SMT, as well, but Nehalem makes use of a shorter pipeline and greater bandwidth between the cores and memory to increase performance. ▲



As shown in this example, Nehalem's SMT can process both orange and blue threads at the same time, allowing for faster performance. In the quad-core processor without SMT, all orange threads must be processed before a blue thread can enter the core.

Source: Intel



Intel will use a 45nm manufacturing process with the Nehalem wafer.

it's possible to adjust the chip's configuration to meet the needs of the market.

SMT. When SMT (simultaneous multithreading) works in conjunction with the multiple cores, Nehalem offers a thread capability of between four and 16.

Tick, Tock

With Intel's new schedule, *tick* represents a new process technology; *tock* represents a new microarchitecture. Intel will announce a *tick* one year and a *tock* the following year.

"Being a *tock* processor, this means this is a place where you see us make significant changes," says Intel's Ronak Singhal, lead architect on Nehalem's overall performance.

Hafnium Overview

Nehalem involves a high-volume 45nm high-k manufacturing technology that will feature Hafnium, a metallic element (number 72 on the periodic table).

As manufacturers shrink transistors, they tend to lose energy to the surrounding area, wasting power and increasing heat (shown in the **A** and **B** transistors), both of which reduce system efficiency.

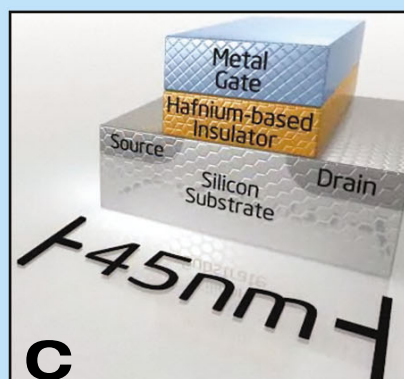
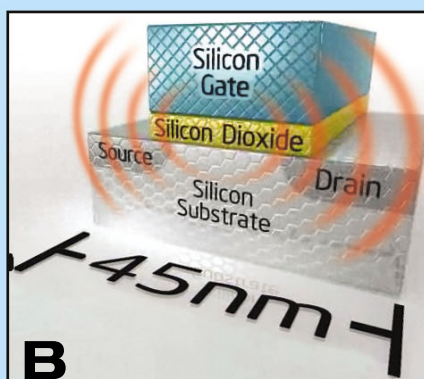
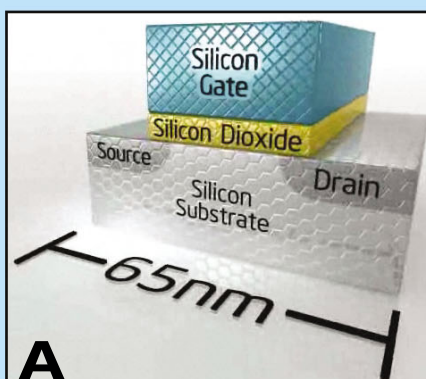
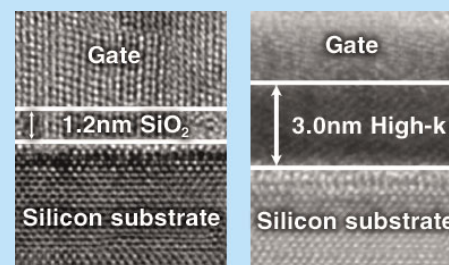
By using a Hafnium-based insulator with a metal gate in its Nehalem 45nm manufacturing technology (**C**), Intel greatly reduces wasted power and improves system efficiency.

Intel announced its plans for using a high-k material in the gate dielectric and for using metal in the gate electrode about five years ago, announcing at the time that the company expected to first feature this technology in its 45nm manufacturing process.

The Hafnium material can be used in a thicker layer than silicon dioxide, which reduces gate leakage by up to 10 times.

Using a high-k material causes a couple of problems, such as excessive voltage during transistor switches, but by using a metal gate with the Hafnium, Intel can negate these problems. ▲

72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium
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Source: Intel

Intel hasn't released any information on clock speeds or on retail availability of Nehalem processors, other than to say production should begin in the fourth quarter of 2008. The *tick* for 2009 will be a Nehalem-type microprocessor with a 32nm manufacturing process (called Westmere), and 2010 will bring another change in the microarchitecture (called Sandy Bridge).

Intel hasn't yet hinted at exactly what changes will take place in 2010, but, if Nehalem is any indication, the next Intel *tock* will bring industry-shaking results again. ▲

by Kyle Schurman

Intel's Microprocessors

Intel hasn't yet released official information on the full specifications for Nehalem, but it's clear Nehalem will continue following the footsteps of other Intel chips that show significant improvements over previous models. Nehalem's quad-core configuration, for example, likely will carry 731 million transistors. ▲

Chip	Manufacturing Process	Transistors	Die Size
Pentium P5 (1993)	800nm	3.1 million	294 sq. mm
Pentium Pro P6 (1995)	500nm	5.5 million	306 sq. mm
Pentium 4 (2000)	180nm	42 million	217 sq. mm
Core 2 Duo (2006)	65nm	291 million	143 sq. mm
Core 2 Duo Penryn (2007)	45nm	410 million	107 sq. mm

Source: Intel

New Intel SSE4.2 Instructions

With seven new Intel SSE4.2 instructions, the Nehalem microarchitecture optimizes processing.

The four SSE4.2 instructions shown in the diagram here optimize string and text processing, and they improve XML parsing (a key communication protocol). Using the new instructions, the system can compare blocks of 16 bytes at a time, rather than having to compare bytes individually.

Equal each operation (1). True when each character in Src2 is in the same position as in Src1.

Equal ordered operation (2). True when finding the start of a substring from Src1 within a string from Src2.

Equal any operation (3). True when any single character in Src2 matches a character in Src1.

Ranges operation (4). True when any character in Src2 is in at least one of up to eight ranges in Src1.

Overall, the new architecture with the SSE4.2 instruction sets will provide improved searching and pattern recognition for large data sets, such as are required with genome mining and handwriting recognition. ▲

Src1: These are the same	Src2: These are the same	Mask: 111110111011101111	1
Src1: sub	Src2: busubusubusubusu	Mask: 0010001000100010	2
Src1: &nf~B#m76btx@	Src2: bad#password123	Mask: 1001000001000000	3
Src1: AZaz09	Src2: #AlphaNumeric#	Mask: 011111111111110	4

Source: Intel

Intel QuickPath Architecture

Intel's QuickPath Architecture is a new platform architecture that provides improvements in processing power, including the inclusion of integrated memory controllers and high-speed interconnects between processors and other components.

QuickPath replaces the front side bus in Nehalem chips, creating high-speed connections between the microprocessors and both the I/O hub and external memory. By providing point-to-point connections using QuickPath, Intel's Nehalem configuration has an advantage over the aging front side bus architecture, where processors must share the bandwidth with other components.

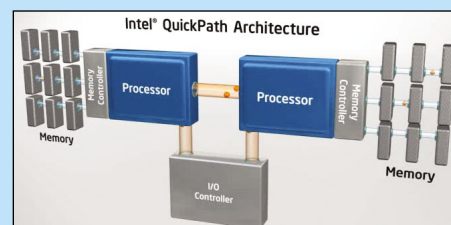
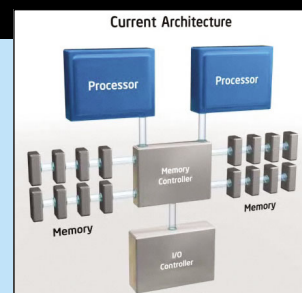
"On the platform side, there's no front side bus," Intel's Singhal says. "That's a huge change for us."

Integrated memory controller. QuickPath allows for 32GB per second memory bandwidth per integrated controller (a total of 64GB per second as shown here). Current architectures only

allow for total memory bandwidth up to 21GB per second.

"There's a massive amount of memory bandwidth," Singhal says. "As we keep increasing the number of cores, we need more memory."

Interconnect between processors. Nehalem allows for up to 25.6GB per second of bandwidth between processors and to the I/O controller. ▲



Source: Intel

CPU **VS.** *GPU*

The Future Of Processing

60 *The Tale Of The Tape*
System Performance Explained In Benchmarks

A New Era Of Computing **66**
Changing Roles Lead To Changing Architectures

The relationship between CPUs and GPUs is ever evolving, as each gains new features and functionality. In the past, if a user wanted a faster PC, he needed a faster processor, plain and simple. But in this age of 3D-enhanced user interfaces, high-resolution gaming, HD video acceleration, and thread-level parallelization, a faster CPU isn't always the answer. And in many cases, a GPU upgrade will have a much greater impact on system performance.

Clouding the matter is the fact that the lines between the CPU and GPU have blurred significantly in recent years. On the desktop, it is becoming increasingly more common for applications to be accelerated on the GPU. And GPUs are revolutionizing the way many different types of data are processed on the enterprise level. These ongoing changes in the industry have spurred much discussion about how PCs will be designed in the future and have sparked heated debates between users. Even the companies involved have traded shots. Nvidia CEO Jen-Sun Huang, when responding to questions regarding Intel's future discrete graphics product Larrabee, went so far as to say that his company would be opening a can of "whoop ass" on Intel.

To gain some inside perspective and a better understanding of where the industry is headed, we decided to speak with representatives from a handful of the most influential companies in PC technology. We spoke with Intel spokesperson Nick Knupffer; AMD's

Vice President of Advanced Marketing Pat Moorhead; the general manager of platform business at Nvidia, Drew Henry; and VIA's Centaur design center president, Glenn Henry. In addition, we got an outsider's perspective by talking with Jon Peddie, president of Jon Peddie Research. Not surprisingly, we received a number of opinions on the future of CPUs and GPUs.

Past, Present & Future

When asked about the current relationship between CPUs and GPUs, Peddie explains things succinctly: "[It's] totally symbiotic. One cannot live without the other.

"The GPU fulfills two opportunities for computer users: It's a graphics accelerator (which is an ASAP [application-specific application processor]) and also a high-performance coprocessor for complex SIMD [single instruction, multiple data] or vector-based datasets used in scientific, financial, and multimedia applications in a heterogeneous architecture. The CPU cannot do the parallel operations that a GPU does, and a GPU cannot do the scalar operations that a CPU does. They need each other, and neither can replace the other."

In other words, there's no single processor in a PC that is good at both highly parallel and scalar operations. As software evolves and computing applications change over time, finding the right balance of CPU and GPU performance becomes increasingly more important for a good user experience.

In response to a similar question about the current and future relationship

between CPUs and GPUs, AMD's Moorhead states, "Before talking about what's ahead, let's first take a look at where we are now. Today's model focuses almost exclusively on adding more of the same CPU cores to chip designs. For certain market segments, such as commercial servers, this model will continue to be the right choice for many years. This is because commercial segments already have extensive access to applications capable of benefiting from greater numbers of homogenous cores."

Moorhead continues, "For the consumer segments, however, the number of applications that benefit from homogenous multicore CPUs drops considerably, especially as the number of CPU cores increases above four." According to Moorhead, an increasing number of software vendors and users are becoming more interested in how they can benefit from accelerating applications beyond CPU optimization. For example, GPUs' highly parallel processing architectures are best suited for 3D applications, working with HD media, and certain other nonvisual applications.

Moorhead's point plays out in modern benchmarks. If an application can't take advantage of multiple threads, adding more cores has little to no impact on a system's performance. Moorhead also hints at the increasing importance of using the GPU for complex parallel computations.

The Impending CPU/GPU Fusion

One of the hottest topics right now is CPU/GPU fusion. Both AMD and Intel

have announced plans to incorporate graphics processors on the CPU die. However, what this means to companies such as Nvidia and AMD (and their partners), which sell many motherboard IGPs, or to the discrete graphics card business, remains to be seen. And although a combined CPU/GPU is likely to offer better performance than current IGP technology because of the closer coupling of the CPU, GPU, and system memory, we won't know just how good performance will be for some time.

When asked about how CPU/GPU fusion will impact the industry, however, Jon Peddie confidently states that, "Embedded GPUs will not be able to deliver the performance needed for interesting multimedia and professional applications like video and picture editing, HD movie viewing, CAD, DCC, HPC applications, and games." Jon's position is one shared by many in the industry, but you wouldn't think that was the case with all of the marketing material surrounding CPU/GPU fusion.

Although he doesn't make any outward performance claims, Moorhead revealed some interesting information regarding AMD's future plans in this area.

"AMD views the combining of CPU cores and accelerator cores on-chip as representing a new category of mainstream microprocessor, which it has titled the Accelerated Processing Unit [APU]," he says. "While the integration of a GPU core within APU designs is a one of our near-term priorities, the APU category represents much more than merely 'CPU+GPU' [in the long term].

"In the future, AMD envisions APUs that include a varying mix of CPU cores (scalar processing cores), GPU cores (parallel processing cores), and fixed-function accelerator cores—all on-chip." Moorhead adds that AMD won't leave out off-chip accelerators, preserving the right hardware combinations for every level of the market. To take advantage of these new architectures, AMD is working toward simplifying the programming environment.

This is an interesting development, even if it is one we have speculated on in the past. Down the road, GPU cores won't be the only specialized cores integrated onto the CPU die. "With the 'Swift' APU, our goal isn't to make the integrated graphics chipsets of today obsolete," Moorhead says, "rather, it's to improve the overall computing experience while improving the cost and energy consumption associated with that type of experience." With the Swift APU, AMD should have a platform that is both cost- and energy-efficient.

A War Is Looming

Aside from CPU/GPU fusion, other recent developments in the CPU and GPU industries have left some companies, predominantly Nvidia, in precarious positions. We don't have to rehash AMD's ATI acquisition here: The results of the merger are well-known. But Intel plans to re-enter the discrete GPU space with the Larrabee product, as well as bolster performance on its integrated GPU. This leaves many to wonder what Nvidia will be able to do without a total platform package. After all, AMD and Intel will be

able to win over consumers and OEMs with top-to-bottom offerings consisting of CPUs, chipsets, and GPUs. Lacking its own CPU, Nvidia has gone on the offensive with a campaign designed to educate consumers on the importance of the GPU and a balanced, optimized PC.

"For mainstream PCs, processing pictures, video, and 3D graphics have become the top reasons for purchasing a PC," Nvidia's Henry says. "GPUs are perfectly designed for these applications. Great new applications are starting to come out, such as RapiHD from Elemental Technologies. This application speeds up the transcoding of SD and HD videos to post on YouTube or watch on your iPod by 10 times or more. GPUs are inherently parallel, so any application that benefits from this parallelism would run great on a GPU."

With all of the fuss regarding GPUs encroaching on territory historically reserved for CPUs, we tend to forget that graphics aren't important to all users. Glenn Henry makes an interesting point: "Compute and data servers typically have little need for graphics. For example, we have over a thousand high-end PCs in our compute center (and we're a very small company), none of which have any display output."

He adds, "The current 'mainstream' PC definitely has need for lots of graphics and image processing power—not just for gaming, but also for video, image processing, fancy 3D interfaces, etc. But these types of systems also have requirements for lots of CPU performance. I'm not sure which need is greater, but a balance, as Nvidia suggests, is certainly required."

What's On The Horizon?

Opinions on where the industry is headed were decidedly mixed, but some common themes did arise in our conversations, namely platformization, parallelization, and integration. "In most cases, mainstream software applications today are already heavily challenged to utilize the full compute capabilities of four CPU cores, let alone 16 or more," says Moorhead. "By combining the optimum mix of CPU cores with differing types of on-chip and off-chip accelerators, platforms can be better tailored to accelerate the types of software a particular end-user segment cares about most. The concept of focus on the platform is such that the right hardware can be used to achieve the hardware balance that's desired, while providing software abstraction layers that make it possible for programmers not to know about these hardware changes."

"Intel drives and defines our products on the platform level, including CPU, chipset, and graphics. It is difficult to predict beyond the announcements Intel has already made on plans to integrate CPU and graphics in a single device," says Intel's Knupffer. Knupffer also says that Intel is currently researching the following areas: integrated 2D mesh networks to directly connect cores and other resources (80-core Terascale chip); speculative multithreading to extract thread-level parallelism at the hardware level; various circuits to accelerate specific tasks such as HD encode and network I/O; new kinds of denser on-chip memory circuits, as well as 3D stacking; resilient circuits and architectures to

push performance higher and reduce voltage thresholds; and fundamental changes to the cache hierarchy to improve memory sharing.

Although not quite as specific, VIA's Glenn Henry makes similar statements. "I see two major thrusts, more powerful, specialized instructions and integration of more function onto [the] same chip as [the] processor: memory controller, graphics controller, most southbridge functions," he says.

Drew Henry, on the other hand, offers more pointed comments. "GPU performance is critical for most users," he says. "We expect to be well ahead in performance and features than the products which integrate a GPU onto a CPU core. Visual computing applications are advancing fast and demanding more and more GPU processing power. The GPU is the processing architecture for the future of computing."

Of course, what AMD, Intel, and Nvidia have to say doesn't always jibe completely with outside observers. Peddie says, "I've said for several years now that the GPU is *the* processor and CPU is the co-processor. The user looks at and responds to the screen the entire time he or she is in front of a computer."

The End Game

Exactly how all of the impending changes to CPU and GPU architectures will affect the industry remains to be seen. One thing is for certain, though: There are going to be some fireworks. ▲

by Marco Chiappetta



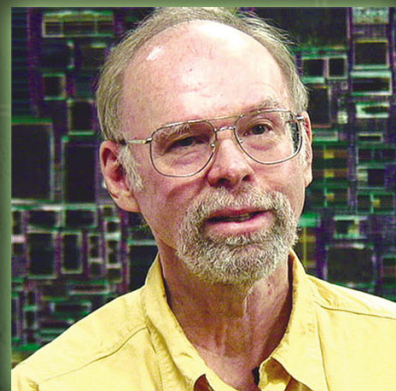
Pat Moorhead

AMD Vice President of Advanced Marketing



Drew Henry

General Manager of Platform Business at Nvidia



Glenn Henry

President of VIA's Centaur design center

The Of The TaleTape

System Performance Explained In Benchmarks

You have a respectable PC, pieced together three years ago using the best of the best. There's an Athlon 64 FX-57 under the hood because—let's face it—AMD was making the rules back then. Your GeForce 6800 Ultra isn't a bad video card, but it's certainly showing age in the newest apps begging for DirectX 10 acceleration. And 1GB of RAM just doesn't stretch as far as it used to. It's definitely time for an upgrade. But where do you start?

To begin, we have a bit of great news. High-performance processors and graphics cards don't have to be the \$1,000+ affairs they were back then. Yes, you can still spend more than a grand snatching up a couple of GeForce 9800 GX2 cards for Quad SLI action. Or you could go out and buy a 3.2GHz Intel Core 2 Extreme QX9770, which is even pricier. But that's brute-forcing the performance picture at a pretty extreme cost. We'd rather know which upgrades are going to pack the most punch per dollar.

If you subscribe to conventional wisdom, gamers are usually best served by a solid video card. There's no better way to tax a graphics subsystem than cranking up the output resolution and turning on eye-candy settings, such as antialiasing and anisotropic filtering. Throw lots of stream processors, graphics memory, and bandwidth at the latest titles and you can expect a solid yield in frames per second.

If, on the other hand, you're doing a lot of video transcoding, content creation, or running productivity apps, a shiny new CPU is probably the clearest path to big performance numbers. Of course, it's no

longer enough to just buy a processor that runs at a faster frequency than your old one. Now there's parallelism to consider. Do you want a quad-core chip that sacrifices clock speed in favor of complexity? Or will a dual-core power plant running a little faster do the trick?

The Numbers Don't Lie

Piecing together a balanced machine means spreading your budget out over the right collection of components. We're going to go out on a limb and guess that you don't *just* edit HDV videos in Pinnacle Studio or play Call of Duty 4 multiplayer. It's important to build a balanced platform, something that can handle a background antivirus scan while you turn two hours of 1080i footage into an MPEG-2 file. Even the right choice in storage will help you stomp out bottlenecks.

Where exactly are those sweet spots, though? To get a better idea of the role each piece of hardware plays in determining system performance, we built two test beds—one Intel box with Nvidia graphics and one AMD platform with the company's own display adapters. Using a handful of CPUs and several graphics cards, we benchmarked each configuration hoping to reveal the components that matter most.

There's a lot of data here, so strap in while we shed some light on how buying the right parts can mean more speed without having to spend more money.

Who Says CPUs Don't Affect Gaming?

Although a modern monster such as AMD's Radeon HD 3870 X2 might go a long way to augment frame rates, sticking

with a single-core CPU doesn't help you take advantage of the threading optimizations in much of today's software, which includes games.

We recently had the opportunity to talk to Tim Sweeny, founder and president of Epic Games, about what multi-core processors mean to the gaming world. When asked how his Unreal Engine 3 is leveraging today's dual- and quad-core CPUs, he responded that the rendering and game update/networking ran in separate threads, delivering great scaling as you move from one to two cores. Beyond that, the physics solver runs in additional threads, hopefully enabling even better performance in physics-intensive scenes with a quad-core chip. More important, though, is that the experience on a quad-core chip is steadier since Windows has computing resources available for its background services. On a single- or dual-core chip, those tasks would detract from game performance.

We posed the same question to Doug Binks, R&D development manager at Crytek. According to Doug, the company's latest title, Crysis, runs in three "heavy lifting" threads. One handles the renderer and game logic. Physics runs in a second thread. And the particle system has a thread of its own, too. "Streaming and audio are also threaded, as is the DirectX 9 runtime," Binks says.

From the way Sweeny and Binks describe the modern gaming scene, if you aren't rocking at least a dual-core processor, you aren't going to get the gaming experience developers on the cutting edge want you to have. That's especially true if

you're running background applications, which keep single-core chips bouncing between tasks. So, while it's seemingly common knowledge that gaming is a function of graphics muscle, bear in mind the effort software developers are putting into threaded code and the demands of apps running at the same time.

So if CPUs are playing a bigger role than ever in games, what are they doing in desktop apps? Quite simply, they're affecting performance more than ever. Sample a handful of encoders, decoders, and renderers. There's a good chance they'll all be optimized for multicore processors. You can get modest speed from an older single-core chip, but you'll be missing out on the beauty of parallelization. Windows Media Encoder, DivX, Cinema 4D, and the LAME MP3 encoder all scale with more processing cores.

Graphics: Helping Define System Performance

Video cards are so closely tied to gaming that it's easy to assume nongamers are safe with mainstream graphics. Think back to our discussion of balance, though. As we'll soon see from the benchmarks, entry-level 3D hardware doesn't complement super-fast processors very well. And with the Windows Vista Aero interface utilizing DirectX 9 cards, there's no good reason to scrimp on lackluster graphics.

A GPU's purpose isn't limited to just pushing faster frame rates in FPS titles or speeding up Vista's UI. The newest graphics processors also help accelerate video playback and determine the display outputs you're able to use. If you plan to watch Blu-ray movies, for example, a modern AMD card with Avivo HD support or a GeForce board featuring PureVideo HD will help guarantee smooth playback. Both of these technologies offload video processing duties from the CPU, freeing up CPU resources for other tasks. And while a motherboard with onboard graphics might give you DVI and VGA outputs, even today's mainstream discrete upgrades offer a pair of dual-link DVI ports to support the richest 30-inch LCDs.

In much the same way an inadequate CPU holds back gaming performance, a

substandard display pipeline will stifle the speed of an otherwise competent machine.

Show Me The Money

Enough theory. Specifications and talk of purported optimizations will only take you so far. At a certain point, it becomes necessary to put rubber to the road and see just how much of a difference threaded software, quad-core architectures, and massively parallel graphics chips make in



Four Cores of Fury: As a larger group of software developers write threaded code, CPUs such as AMD's Phenom X4 9850 Black Edition offer greater performance advantages.

Getting good graphics performance doesn't always mean buying the fastest card around. AMD's Radeon HD 3870 delivers solid frame rates at a sub-\$200 price tag.

improving performance. Let's get into some real-world, hands-on testing.

Our goal is to determine how each piece of hardware ranks in the hierarchy of system alacrity. Given a limited budget, are you best-off adding processor muscle, graphics horsepower, or stepping down a notch in both categories to afford a couple of upgrades? Answering that question means testing a broad range of hardware using relevant benchmarks. The metrics we've chosen range from purely synthetic to real-world applications. In the synthetic tests, you get the most pronounced results

at the cost of applicability; nobody gets off work, heads home, and kicks back with a couple hours of the 3DMark06 CPU test. The real-world benchmarks are much more representative of the software you actually use, but they're often harder to interpret and more prone to larger margins of error. After all, a game such as Unreal Tournament 3 is a fragfest first and a benchmark second. Testing properly using the botmatch technique introduces plenty of variance in how the AI reacts from one run to the next.

We're also dealing with multiple hardware variables here, which make benchmarking more complex than simply swapping out processors or trying different video cards. Rather than creating a confusing array of charts showing how each CPU performed with our many GPUs and how each GPU performed with all of the CPUs, we created a sliding scale. On one end, there's the entry-level processor paired up with a high-end graphics card. On the other, you have flagship CPUs dragging integrated graphics chipsets behind them. And in between are the more serious contenders—platforms that combine better-matched processors and graphics cards.

Starting Out Synthetic

Several years ago, the online enthusiast community spearheaded a big backlash against synthetic benchmarks. Tests such as 3DMark were being tampered with by graphics vendors who knew the benchmark's camera path and knew it'd be the same from one run to the next. By manually reducing the rendering workload based on that knowledge, vendors were able to artificially inflate their products' scores. Consequently, in the days of 3DMark03, the credibility of synthetics was called into question. Why bother buying a benchmark suite and generating an arbitrary result if it wasn't even a meaningful basis of comparison to other systems?

The furor over unethical vendor behavior has since died down and synthetic tests are more warmly regarded, or at least indifferently tolerated. After all, there *is* value in running synthetics. In a paper presented at the 2008 SPEC Benchmark

Workshop in San Francisco, three researchers from the University of Texas at Austin and Ghent University in Belgium helped explain the relevance of synthetic testing, especially when the benchmark is developed to be representative of real-world performance. The group's points were illuminating.

For instance, when you run a timed demo in *Crysis*, the result tells you plenty about hardware performance in that one app, but little about how the same configuration might fare in a game written by a different developer. Futuremark's 3DMark06, on the other hand, includes two Shader Model 2.0 tests, two Shader Model 3.0 tests, a threaded CPU workload, and a handful of individual feature tests. Because you get complete control over the benchmark environment and workload characteristics, 3DMark06 is able to represent what you might expect from a larger sample of real-world games.

The PCMark Vantage story is similar. We can run media encoding and software rendering tests all day long. But again, you're looking at rigid measurement of a single performance point in individual programs. Vantage creates an environment where multiple tests can run concurrently, with the purpose of showing off what multicore processors, fast hard drives, and large memory repositories can do in a way not otherwise possible. Best of all, Futuremark, the maker of PCMark Vantage, offers an in-depth explanation of each benchmark suite. So, if you're looking to compare disk subsystems, it's easy to reference the Vantage white paper, see that the TV And Movies 3, Gaming 2, and Productivity 3 tests are all great drive benchmarks, and then draw meaningful conclusions about the scores.

It's hardly a surprise, then, that the two synthetic benchmark suites effectively demonstrate that adding a strong processor or powerful graphics card to an otherwise modest hardware configuration is not the way to improve performance.

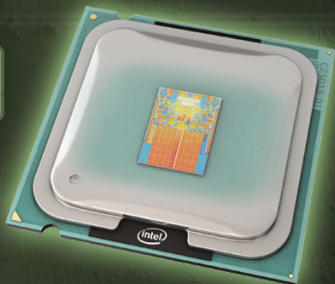
3DMark06 Analysis

Start with the AMD machines powered by ATI graphics. The results gleaned

from 3DMark06 using an Athlon X2 4000+ and two Radeon HD 3850 cards in CrossFire were so low that we had to run the same setup with just one graphics card to confirm the benchmark was



For about \$50, you can add a discrete Radeon HD 3450 to a motherboard based on AMD's 780G chipset and enjoy a CrossFire-like configuration called Hybrid Graphics.



Intel's 45nm Wolfdale core, on which the Core 2 Duo E7200 is based, gives you lots of overclocking headroom and a beefy 6MB L2 cache for extra performance.



Excellent graphics performance and a reasonable price makes Nvidia's GeForce 8800 GT a great choice in a balanced PC. If you still need more speed, add another 8800 GT to a compatible platform for SLI operation.

running properly. Dropping one of the 3850s took us from 8107 3DMarks to 7417 3DMarks. Ouch. Our mainstream CPU choice was absolutely choking graphics performance. At least we knew we had a serious bottleneck to address.

Stepping up from the \$50 Athlon X2 4000+ to the \$90 Athlon X2 4850e bought us an additional 400MHz and a massive increase to 9158 3DMarks using the same graphics setup.

Now here's where the story gets a lot more interesting. A 2.5GHz X2 4850e (\$90) and a pair of Radeon HD 3850s (\$140 each) cost roughly \$370. Now, the next data point in our chart is a 2.1GHz Phenom X3 8450 and a single Radeon HD 3870, which posts higher graphics *and* processing scores in 3DMark06. The prices for those parts add up to about \$320. More performance and a lower price? We'll take it. Talk about a glowing endorsement for doing your homework before buying an upgrade, too. Although the triple-core Phenom is at a clock speed disadvantage, it offers a faster HyperTransport link, dual power planes for better energy efficiency, and an extra core. 3DMark's threaded engine makes up for the loss in graphics muscle by better utilizing the more capable CPU.

We didn't get the same effect by upgrading to a quad-core Phenom X4 9550 while simultaneously stepping down to an AMD 780G-based motherboard running a Radeon HD 3450 card with Hybrid Graphics technology enabled. But the surprising news was a drop in processor performance after moving to the 2.2GHz 9550. Could it be that a mainstream chipset hosting mainstream graphics was holding back our processor's extra core and 100MHz? We pushed the extremes even further to find out.

We dumped AMD's flagship Phenom X4 9850 into the socket and yanked the discrete Radeon HD 3450, leaving us with an integrated Radeon HD 3200-series engine propelling the platform. Needless to say, 3DMark06 didn't approve. Graphics performance fell through the floor, and the CPU test slowed even further.

Our AMD results were somewhat reinforced by running Intel's processors and Nvidia's graphics cards through the same gauntlet. The overall 3DMark score was highest when we used a vanilla GeForce 8800 GT and a Core 2 Quad Q6600 processor. Neither component is

best-in-class, but the balanced combination meshed well.

Stepping up to a Core 2 Extreme QX6850 running at 3GHz supercharged the suite's CPU benchmark. However, the integrated GMA X3500 graphics core neutered the platform's ability to handle gaming—so much for brute-forcing 3DMark. On the other side of our fastest performer was a Core 2 Duo E7200 complemented by an overclocked GeForce 8800 GT. The results fell off even further after moving to a dual-core Pentium E2200 and GeForce 8800 GT SLI combination, again showing that super-fast video cards can't carry Futuremark's threaded benchmark on their own. You really need a decent processor to round things out.

We've only tested one synthetic benchmark, and it's already clear that there's no single keystone supporting the other pieces of hardware composing today's PCs. Abandon balance and you introduce bottlenecks, which invariably hamper performance.

PCMark Vantage: Vista-Only, Please

Our other synthetic suite in our repertoire was Futuremark's PCMark Vantage. This one measures system performance in Windows Vista using eight different collections of tests. The first one yields an overall score, while others zero in on more specific usage models. Within each collection, four workload distributions are designed to tax hardware by loading down processors, memory, graphics, and storage. Because that's a lot of numbers to look at when you break the results down completely, we'll present the overall Vantage score along with each of the workload scores and leave out the individual component tests.

Futuremark describes the full PCMark score as 12 single- and multithreaded CPU, graphics, and storage scenarios, with an emphasis on applications included in Windows Vista. Referencing the PCMark Vantage whitepaper hosted on Futuremark's site gives you a better idea of what pieces of Vista the suite uses to measure hardware performance. Averaged together, the benchmark delivers a solid assessment

of how four subsystems interface. If ever there was a metric that'd protest an imbalanced machine, this is it.

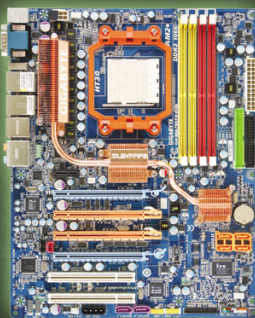
Vantage is far more forgiving of low-end graphics than 3DMark06. In fact,



Substandard 3D performance makes it hard to like Intel's G35 chipset. However, video acceleration and full Vista Aero support are at least reasons to consider the core logic in a business environment.



The 45-watt Athlon X2 4850e works well in power-sensitive environments, where its two cores running at 2.5GHz can still serve up plenty of performance.



AMD's 790FX is one of the strongest reasons to buy a Phenom. Gigabyte's MA-790FX-DQ6 gives you four PCI-E x16 slots for serious scalability through CrossFireX.

now it's processing horsepower that seems to scale the best. The Phenom X3 8450/Radeon HD 3870 was still the top performer from AMD's lineup, reaffirming the 3DMark numbers. On the Intel side, our Q6600/GeForce 8800 GT takes the top spot, as well, demonstrating the power

of quad-core computing to those who do a lot of multitasking. It's also worth noting that the Core 2 Extreme configuration may have put down even faster scores. However, because Intel's Vista graphics drivers for the G35 chipset are incomplete at best, our board wouldn't finish a run of Vantage until we disabled the Memories suite. Even then, the board failed the PCMark and gaming suites.

The Memories benchmark uses Vista's Windows Photo Gallery and Windows Movie Maker to manipulate high-def images, edit video, and transcode from DV to WMV9. With seemingly equal emphasis on processing, storage, and graphics, the well-balanced Phenom X3 8450/Radeon HD 3870 and Core 2 Quad Q6600/GeForce 8800 GT again assert themselves as the fastest hardware combinations. The Gaming suite, which also juggles processor, graphics, and storage performance evenly, favors the same two systems.

It's only when Vantage started emphasizing processor performance that other configurations started showing what they can do. For instance, in the TV And Movies test, AMD's Phenom X4 9550 and Hybrid Graphics setup posts the best numbers. The Intel Core 2 Extreme took a first place finish, too, despite the anemic GMA X3500 attached to it. The Core 2 Extreme also dominated the Music, Communications, Productivity, and HDD tests. Meanwhile, AMD's Phenom X4 9850 topped the charts in Productivity and Music.

Gaming: Stack The Deck

Where synthetics such as 3DMark fall short is their ability to represent the performance of real software. Games are especially tricky to test because each centers on a different engine written at different times by developers looking to expose different capabilities. So although a game like Half-Life 2: Episode 2 might still be tons of fun to play, its Source engine is extremely responsive to a faster graphics card and much less affected by the addition of a multicore processor. On the other hand, a title like Unreal Tournament 3, which we already know was developed to take advantage of

threading optimizations, benefits much more from a platform that boasts multiple cores.

Crytek's Crysis, being one of the most demanding games available right now, makes for a particularly interesting case study. At 1,600 x 1,200 with just a pinch of antialiasing, Crysis is so graphically

intensive that even a simple Athlon X2 4000+ didn't suppress performance. Intel's Pentium E2200 was ample, too, because it seemed the dual GeForce 8800 GTs were our bottleneck. This news won't come as a surprise to anyone who already plays Crysis: Threaded engine or not, this game is a serious test of your graphics subsystem.

Unreal Tournament seems to come in at the spectrum's other end. The game looks great and definitely asks for a capable discrete card (as evidenced by the weak frame rates you get from an integrated engine). However, it also responds very well to multicore processors. As long as there's a respectable GPU under your hood

Finding The Sweet Spot

For all the talk of CPUs and GPUs taking over for the other, it's clear that you can't yet have one without the other. As you can see, equipping the world's fastest GPU with an anemic CPU (and vice versa) yields poor results, while a balanced approach produced the best overall scores. ▲

AMD Results

CPU	Athlon X2 4000+	Athlon X2 4850e	Phenom X3 8450	Phenom X4 9550	Phenom X4 9850
GPU	2x Radeon HD 3850	2x Radeon HD 3850	Radeon HD 3870	Radeon HD 3450 (Hybrid)	Radeon HD 3200 (780G)
3DMark06 Overall	8107	9158	9296	2473	1380
3DMark06 CPU	1532	1754	2319	1883	1716
PCMark Vantage Overall	3042	3293	3822	3578	3351
Memories	2589	2870	3053	2250	2012
TV And Movies	2432	2622	2977	3108	2678
Gaming	3266	3496	4045	2871	2545
Music	3198	3492	3799	3928	3957
Communications	2436	2740	3156	2815	2847
Productivity	2609	3237	3737	3781	3794
HDD	3661	3591	3590	3527	3550
Windows Media Encoder 9 (VC-1)*	2:51	2:31	2:03	2:39	2:56
LAME MT v.3.97 beta 2*	2:41	2:14	2:15	2:21	2:45
Crysis (1,600 x 1,200; 2xAA)	28.95	28.96	21.84	4.08	2.16
Unreal Tournament 3 (1,600 x 1,200)	30.42	31.87	44.51	9.09	4.71
Half-Life 2: Episode 2 (1,600 x 1,200; 4XAA/8XAF)	82.15	85.54	60.48	10.82	6.58

Intel Results

CPU	Core 2 Extreme QX6850	Core 2 Quad Q6600	Core 2 Duo E7200	Pentium E2200	
GPU	GMA X3500	GeForce 8800 GT	GeForce 8800 GT AKIMBO	GeForce 8800 GT SLI	
3DMark06 Overall	614	11770	11013	9437	
3DMark06 CPU	3969	3544	2276	1854	
PCMark Vantage Overall	N/A	4380	3569	3224	
Memories	N/A	3912	3292	3125	
TV And Movies	3544	3414	2700	2159	
Gaming	N/A	4686	4061	3373	
Music	5021	4435	4035	3435	
Communications	4239	3708	3237	2895	
Productivity	4678	4062	3630	3015	
HDD	3568	3518	3556	3533	
Windows Media Encoder 9 (VC-1)*	1:26	1:42	2:00	2:28	
LAME MT v.3.97 beta 2*	1:30	1:49	1:38	2:00	
Crysis (1,600 x 1,200; 2xAA)	0	32.43	33.79	48.53	
Unreal Tournament 3 (1,600 x 1,200)	0	65.91	51.76	44.77	
Half-Life 2: Episode 2 (1,600 x 1,200; 4XAA/8XAF)	0	86.78	93.78	89.9	

(the Radeon HD 3870 and GeForce 8800 GT work well), a Phenom X4 or Core 2 Quad will give you some impressive gains.

Somewhere in between Crysis' graphics demands and Unreal Tournament's responsiveness to threading sits Half-Life 2: Episode 2. For the most part, Valve's latest hit looked like it craved the power of an amped-up GPU. However, there was also a definite step up in speed when we moved from the Pentium E2200 to the Core 2 Duo E7200 and Athlon X2 4000+ to Athlon X2 4850e. But past a certain point, this one's all about the graphics.

Surprised to see CPUs playing such a prominent role in gaming performance? Don't buy into claims from graphics vendors who say processors don't make anything run faster. It's simply not true. We've seen them make games faster—especially games such as Unreal Tournament, intelligently optimized to run in multiple threads. And we're about to see AMD's and Intel's respective offerings leverage parallel cores to help accelerate encoding tasks.

A Little A/V

The last two tests we chose were Microsoft's WME 9 and the LAME MP3 encoder, which, in its latest beta form, is able to take advantage of multiple processor cores.

AMD disclosed to us that there's currently an issue in WME 9 where the app recognizes only one, two, or four cores. So, by default, WME 9 sees a triple-core chip as a dual-core processor. But that didn't seem to be the case at all: AMD's Phenom X3 8450 laid down the fastest VC-1 encode. Even more remarkable was how much performance we lost by moving from the X3-based platform (which used a Radeon HD 3870 graphics card) to the faster X4s that we hampered with integrated graphics. The Intel platforms aren't subject to the same parabolic performance graph, as the 3GHz quad-core Core 2 Extreme finished our encoding job in just 86 seconds.

The same trends carried over into our LAME audio encoding tests. If you aren't familiar with LAME, it's the encoding engine used to drive a long list of open-source, free closed-source, and commercial

audio apps, such as Winamp, Audio-grabber, and iTunes-LAME. Multithreading optimizations in the latest beta build let the 2.1GHz Phenom X3 to match pace with the 2.5GHz Athlon X2 4850e. They also helped propel the Core 2 Extreme to another victory, despite its platform's integrated graphics subsystem.

A Tale Of Two Platforms

You can learn a lot by benchmarking hardware. Just remember that there's always a story the benchmarks don't tell you. Every single one of our tests features tweaks to improve the performance of multicore processors. The resolutions we used to evaluate gaming are especially hard on graphics cards, which is why you see the integrated solutions fall flat on their figurative faces. Swap out the tests for apps running in a single thread or drop those resolutions to

640 x 480 and you'll see significantly different results.

What conclusions can we draw about our two systems? Well, to begin, it's important to note the many other variables affecting system performance. Double the memory, add a second hard drive in a RAID 0 array, install a physics co-processor—a million little things can push or pull benchmarks scores.

More telling, though, is the fact that no one component can claim to be more important than the others. Slide too far on either side of our scale and you're bound to torpedo performance in some application class. Building with balance in mind is the better choice by far. If that means stepping down a notch on the graphics for a better processor, well, you know what they say: The numbers don't lie. ▲

by Chris Angelini

How We Tested

Good benchmark results can be replicated, so long as you're using a similar hardware and software environment. If you'd like to test your own configuration and compare it against our numbers, here's how we set up each contender.

We used two motherboards for testing five machines based on AMD processors. The two setups employing integrated graphics (both armed with Phenom X4 processors) centered on Gigabyte's MA78GM-S2H motherboard. The other three were powered by Gigabyte's MA-790FX-DQ6. Both platforms featured the latest official BIOS files—important if you plan on testing a newer processor, such as the Phenom X3 8450.

Although we swapped out the processors and graphics cards, both boards shared 2GB of Corsair DDR2 memory running at 800MHz and 5-5-5 timings. We also used a 1TB Seagate Barracuda 7200.11 drive in all five test beds. The same 1,000W PC Power and Cooling PSU and Plextor DVD burner remained constant, as well.

Our integrated GMA X3500 numbers came from an Asus P5E-VM HDMI motherboard, which we immediately swapped out in favor of Asus' 780i-based Striker II Formula for the rest of the benchmarks featuring Intel processors. We stuck to the same Corsair modules for testing the G35-based motherboard and then switched to a pair of OCZ DDR2-1066 sticks on the Striker board.

The software environment used Windows Vista 32-bit, updated with all available Windows Updates as of April 18, 2008. We updated each of the benchmarks with the latest patches and downloaded the drivers for each hardware component straight from sourced vendor. We didn't use any beta drivers, which means nothing from Nvidia's nZone pre-release page. Of course, we disabled UAC in Vista.

We ran 3DMark06 and PCMark Vantage using default settings, though the 780G-based machine required an updated Direcpl.dll file in order to run properly. For WME 9, we timed a VC-1 encoding session of the "Terminator 2" preview available from Microsoft using the streaming, constant bit-rate preset. For LAME MT, we downloaded the latest version and converted the "1812 Overture" from .WAV to .MP3 using the following command line: `lame.exe -b 192 1812.wav 1812.mp3 -nores`. We tested Crysis, Unreal Tournament 3, and Half-Life 2 using custom demos, so comparing those game scores would be difficult. ▲

***A New Era Of** Computing*

Changing Roles Lead To Changing Architectures

The snapping sound you just heard if you were listening carefully was your old PC architecture finally breaking. PCs have displayed astounding longevity and backward compatibility dating back to the early 1980s. Clocks, buses, RAM, and CPUs have all accelerated, but the fundamental PC architecture has not changed dramatically since it was first introduced. The tide began to shift five years ago as Moore's Law abruptly ground to a crawl and the huge clock speed leaps that had marked each previous generation of CPUs disappeared. To achieve further performance increases without melting the fragile CPU, chipmakers had to resort to spreading the burden of performance more broadly across the chip with greater parallelism. Today we're on the brink of a shift in computing more profound than when the venerable 486 and 487 math coprocessors were unified on a common processor called the Pentium. Just as the inevitable conclusion that floating-point processing had become an essential component of the modern general-purpose processor, so too has the day come when the GPU is recognized as an essential and integral component of computing.

The transition we are facing is not, however, as simple as slapping a GPU on the same die as the CPU and calling it quits. If a GPU were truly no more than a

graphics processing unit, it would make little sense to incorporate the GPU with the CPU because graphics architectures evolve extremely rapidly, and binding its feature set to the backward-compatibility burden of the CPU might dramatically slow innovation. The evolutions of the CPU and GPU were previously decoupled. Intel and AMD invented next-generation CPUs for enterprise applications, shipped them in high-end workstations and servers, and, when the cost of the chips got low enough, rebranded them for consumer PCs and slapped a GPU next to them on the motherboard or with an add-on card to compensate for the many shortcomings a CPU designed for enterprise applications had for highly media-intensive consumer applications.

This cycle might have continued forever were it not for several inconvenient changes, despite Intel's and AMD's strained efforts to convince consumers that multithreaded, multicore CPUs designed to cope with ever larger servers and enterprise databases were somehow relevant to consumer computing. After several failed initiatives to convince game developers that convoluting their games to take advantage of greater parallelism would improve game performance, it has finally become obvious to both chipmakers that something has to change. The interests of enterprise computing and consumer computing have

diverged so dramatically that the strategy of treating consumer computing as a hand-me-down market for enterprise chips has become unsustainable. To begin with, nearly 70% of all consumer PCs sold today are laptops whose cost, form factor, and power management requirements are in direct conflict with the needs of big enterprise database servers. The high-end PC game market has been displaced by next-generation consoles, and even the souped-up PCs that *CPU* readers buy for gaming provide the best bang for the buck when you invest more money in the GPU rather than the CPU.

Furthermore, a little more parallelism is no longer enough to achieve greater performance. Convincing developers to contort their code to optimize for two cores or two processors was a nearly insurmountable marketing challenge for Intel and AMD; how then to convince them to take advantage of four, eight, 16, or many more?

Realistically, it's unlikely that many human minds are capable of manually chopping an enormously complex real-time application such as a game into an efficient parallel application using the primitive coding tools of today, which were designed to enable simple serial applications to run on simple serial processing computers. There are two types of bugs programmers dread dealing with because of the legendary difficulties with debugging them. These are

timing and synchronization bugs. Have you noticed that most of the patches we download for our multiplayer games are networking fixes? The myriad timing and synchronization issues raised by multiplayer games make them the most difficult to test reliably. Making a real-time game run across multiple threads and multiple processors turns the entire application into a tangle of timing and synchronization challenges that significantly complicate the application's development and jeopardize its stability.

GPUs already support many concurrent cores without requiring any modification on the game developer's part to take advantage of them. The Direct3D driver takes a stream of serial rendering instructions from the CPU and passes it up to the GPU, which automatically chops the computations into highly efficiently distributed parallel computations. Slower, lower-cost GPUs from ATI and Nvidia sport fewer processing cores and less memory; faster versions sport more cores and more memory. The standard Intel integrated graphics component shipping today, the G35, has eight execution cores, while the latest high-end GPU from ATI boasts 320. Scaling between the different architectures is handled automatically by DirectX and the GPU, thus enabling the developer to focus on making a great game without undue worry about how to parallelize it for rendering efficiently. This architecture also illustrates at least one proven approach to authoring applications that benefit from arbitrarily scaled parallelism without manual developer support for multithreading.

The question remains, however: How does the ease of parallel scalability associated with DirectX programming of the GPU relate to a change in general-purpose computing? Over the years, a strange transformation has occurred in Direct3D. DirectX 8.0 introduced the idea of programmable vertex and pixel shaders. A game developer could write specialized assembly language programs just for the GPU that would modify the color of a pixel or the position of a 3D point in space in real time on the graphics hardware. Subsequent versions of DirectX generalized the programmability

of these graphics elements and made them accessible to high-level language support to such a high degree of abstraction that it no longer matters that they were originally designed as very specialized processing elements for graphics. They are each, in effect, general-purpose programmable processors. This transition is not unlike witnessing the evolution of wings on tree-dwelling dinosaurs firsthand over the course of just a few years. The ramifications for computing spread well beyond the obvious improvements to graphics performance just as evolving wings had vastly greater ramifications than simply enabling dinosaurs to hop longer distances between tree branches. This seemingly subtle shift in PC architecture driven by graphics is causing a chain reaction that will fundamentally overturn computing as we know it today.

Underlying this change is the fact that throughout the history of computing, there have been problems, such as those our brains solve effortlessly every moment, that have seemed beyond our reach or comprehension to solve with the thinking machines we have been able to make. Although it's fun science fiction to speculate about artificial intelligence and sentient machines, there are many very clear practical problems that we also have been unable to solve. For example, why does Microsoft still need thousands of engineers to write an operating system? Why don't they just write a program that writes Windows for them? For all the claims of climate models predicting the end of the "environment," the truth is that computer scientists can't even write a program that accurately predicts where a plastic bead dropped in a jug of water and shaken for 30 seconds will end up, let alone accurately predicting winning lottery numbers, stock market fluctuations, or precisely where it will rain tomorrow. These are all problems that are well beyond computation as we know it today.

Who imagined that the lowly transistor, invented by Bell Labs and announced in 1948 as a brilliant alternative to vacuum tubes for controlling the switching of signals in phone networks, when packed in a modern consumer-grade computer by

the hundreds of millions, would be a practical solution to enable people to play World of Warcraft in a virtual world together in 2008? Welcome to the future. To make a highly speculative analogy, consider that the past 50 years of computer innovation have effectively culminated in single consumer CPUs computationally capable of reproducing the processing capacity of a single human neuron. For the past 50 years, we've been programming at the DNA level of the cell. Not coincidentally, the human genome is composed of about 3GB of data. The transition to highly parallel programming driven by real-time 3D graphics is loosely analogous to a transition from programming at the DNA level of a cell to wiring whole processing networks together out of neurons.

In retrospect, it makes sense that 3D graphics would lead such a transition, since real-time 3D is really a real-time virtual reconstruction of a reality generated by a computer to fool the human eyes and brain into thinking that it is looking at and interacting with reality. It took a highly parallel ("brain-like," if you will) GPU architecture to visualize and model reality in a way that could fool the human mind into thinking it is experiencing reality during gameplay. If the GPU is roughly analogous to a hard-wired implementation of the circuitry that makes up the human visual cortex, then unifying GPU architecture with the CPU represents a removal of the hard-wired constraints that confine the utility of this incredible programming paradigm to just 3D graphics.

Want a fast way to simulate a supernova explosion, model molecular interactions, process radio signals, or simulate the stress on a new suspension bridge design? Need to calculate the collisions between every point on a piece of clothing with every contact on an animated character to produce realistic fabric motion? Want to decompress, decode, and filter HD video? Or maybe you'd like to run complex AI simulations across thousands of virtual characters in real time? That GPU is beginning to look like an amazingly efficient, intrinsically parallel general-purpose architecture for

solving a broad class of computing problems that were previously beyond the realm of interactive real-time analysis.

In addition to inherent parallelism, there is another feature that makes the GPU extremely fast. A high-end gaming card with 512MB of video RAM will include a highly specialized memory manager that provides each processing core with fast access to its own caches of memory. This is important because when a GPU renders a 3D scene, it is really rendering a 4D scene and smashing it down to a sequence of frames in the two dimensions we see on-screen. Each pixel in a 3D scene may be rendered dozens to hundreds of times before arriving at its final displayed color. Without extremely fast access to its own cache and region of the frame buffer via many parallel buses rather than one monolithic shared one, performance would be abysmal. Integrated video chips sold with most low-end computers share access to system memory on the same monolithic bus as the CPU, often overloading the shared system memory bus with heavy memory-intensive traffic. This is one of the historical reasons that \$200 to \$300 game consoles have been able to outperform \$2,000 to \$3,000 PCs graphically for so many years. Proprietary console architectures were able to unify CPU and GPU memory bus architectures for extreme gaming performance using very cheap components many years ago without concern for the backward-compatibility legacy of the PC architecture.

Once the GPU as a processing architecture has evolved to such robust generalization, it becomes clear that its design has many unquestionable advantages over the venerable CPU architecture for a broad array of exciting new computing applications, but also some disadvantages that would benefit from the flexibility of modern CPU designs. The CPU's versatility as a general-purpose processing chip derives from several interesting architecture features. The CPU itself is not a serial processor; it is itself a composite of two earlier chip architectures: the IPU, or integer processing unit, and the FPU, or floating-point processing unit. When these chips were integrated in the Pentium, they were

also parallelized to share common access to local cache memory, thus enabling the IPU to identify integer instructions in cache memory and operate on them concurrently with the FPU identifying floating-point instructions from the same memory and operating on them independently. Multiple cores, which are in turn composites of the IPU and FPU, now share fast access to the cache, thus enabling each of them to run separate processing applications or share work from a single parallelized application between them.

Unlike the GPU, the CPU is particularly adept at dealing with branching, a common feature of complex serial programs that requires the CPU to make a decision about which body of code to execute next. Here is a simple example of a branching situation in code:

```
If (A+B) > 2.67
    Then execute this code
    Else execute this code
```

Code like this can bring parallelism to a halt because the CPU doesn't know which piece of code to execute next without the result of the IF condition being resolved first. Branching code is the enemy of automating parallelism because it blocks the processor from batching up a pile of computational work and divvying it up among multiple independent processing cores. Modern CPUs have a feature called branch prediction, which basically means they take educated guesses as to which branch of code to work on and get started on it even before the branch condition is resolved. If the CPU guesses wrong, the parallel pipeline stalls, the incorrect branch calculation gets flushed, and the CPU starts calculation on the correct branch, having lost its parallel advantage and wasted clock cycles for that calculation. In this feature, the CPU has effectively enabled two very different processing architectures to operate relatively efficiently in close cooperation to solve a serial computing problem in parallel, again without expecting developers to adapt their code to take advantage of this feature.

The most valuable new processing feature that the GPU brings to the CPU is extremely fast, highly parallel vector processing. Put

simply, adding a VPU (vector processing unit) alongside the IPU and FPU creates a highly versatile new kind of CPU that is proficient at physics, AI, collision detection, 3D transformation and lighting, and so on. Merging the GPU with the CPU's powerful branch prediction and shared access to extremely fast local memory will give the venerable CPU a new lease on relevance in computing.

Practical Impact

Forgetting all the revolutionary leaps in computing power and real-time data processing, what impact will all of this have on something really important, such as the games we play? As amazing as modern gaming graphics appear, we have hit a wall in achieving further compelling advances that can only be breached with further generalization of the GPU architecture. The wall is this: The more realistically we render 3D objects, the more unrealistic and wooden they appear when they move and interact with each other. They exhibit a rigid range of motion, their interactions with the environment are carefully constrained, their muscles don't flex naturally, their faces don't crease naturally, their hair or fur doesn't flow naturally, and so on.

Today, developers conceal many of these limitations through an increasing volume of very clever art and game design, but at some point, further advances in realism won't be practical without a fundamental change in the way 3D environments are created. These issues and many others associated with realistic dynamic lighting and shading effects stem from the need to calculate the interactions of collisions between a huge number of virtual objects in real time, a common physics problem. As the number of objects in a 3D scene expands geometrically, the number of collisions that need to be calculated expands exponentially. Here are just a few of the types of collisions that a 3D game has to resolve in real time:

- Collisions between the player and every element in the environment, moving or static
- Collisions between sounds and various materials to produce realistic 3D audio

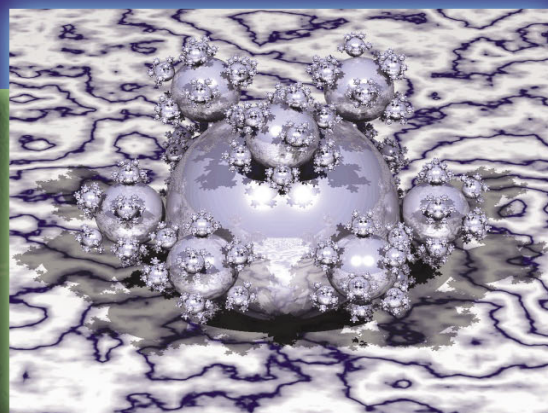
- Collisions between the player's point of view and the world to calculate what the player can see
- Collisions between nonplayer AI characters and the environment to calculate what they can see, hear, or think
- Collisions between AI characters and the environment to calculate the paths they can travel realistically
- Collisions between light sources and all physical objects in the world to calculate lighting effects and shadows
- Collisions between attacks the player or AI characters launch and their targets
- Predictions of possible collisions between moving objects in a multiplayer game to calculate motion compensation to hide network latency

Some of these types of collisions (especially those related to physics) are best calculated by the CPU because of its highly efficient branch processing. Others, such as those related to identifying how 3D objects intersect with one another in a 3D scene, are best handled by a GPU because it can apply extremely fast hardware shortcuts that solve the problem without doing millions of costly matrix calculations. The problem is that because the CPU and GPU are often separated by a relatively slow, one-way bus connection, they usually cannot cooperate to optimize collision calculations efficiently between them. On the PC, the CPU must first batch up all the computational value it can add to a scene and then hand it off to the GPU for final processing. Any collision effects that may benefit from a combination of CPU and GPU approaches to vector processing must be forgone, or faked on the GPU.



Shadows are one graphical effect that has to be "faked" separately by a GPU.

Ray-traced images courtesy of:
Henrik Wann Jensen
(henrik@cs.ucsd.edu).



These are ray-traced images based on highly realistic physics calculations of light rays colliding with and reflecting off of solid and translucent objects. Although vastly more versatile and realistic for rendering 3D scenes, ray tracing is not a practical real-time technique. CPUs are very adept at performing the light collision calculations involved in this process, but they cannot efficiently do much of the rest of the work required to perform ray tracing. So instead, these kinds of 3D effects are "faked" on the GPU producing "realistic" results that are comparable but often less dynamic.

The same is true of interesting game AI, which requires enormously complex

branching state management to produce interesting behavior but also an enormous volume of collision calculations for an AI character within the game environment. The CPU can easily handle the branching calculations, but not the collision calculations, which allow nonplayer characters to "sense" their situations in the game and make "intelligent" decisions about how to react to them.

Since the flow of 3D information on the PC has largely been a one-way street from the CPU to the GPU, the GPU has had to become more generalized in order to cope with its shortcomings, the result being that more and more of a game's physics and collision calculations are being

taken away from the CPU and handed off to the GPU for processing. Thus the CPU has declined in value to gamers even as Intel and AMD have stuffed more cores onto their processors for enterprise applications and then tried to sell them downstream to consumers. The only way for AMD and Intel to combat their dwindling relevance to consumer computing is to try to subsume the GPU into the CPU. To that end, AMD has acquired ATI and announced its Accelerated Processing Unit chip category (which is part of the company's overarching Accelerated Computing initiative that also covers work on general-purpose GPUs), and Intel is prepping Nehalem and Cantiga (its G45 mobile chip) and Larrabee GPU initiative, which is still shrouded in some mystery.

Coming Soon

Intel reports that its next-generation consumer CPUs launching later this year based on the Nehalem architecture will feature CPU and GPU components on the same chip. Intel claims that its new CPU/GPU integrated mobile chips for laptops will be 10 times faster than its current-generation integrated graphic components by 2010. Similarly, AMD has plans to release its first APU, a new mobile component code-named "Swift" that sports an integrated CPU, GPU, UVD (universal video decoder), and memory controller.

Although these components won't necessarily blow the doors off a high-end ATI or Nvidia expansion card, they will represent a substantial leap in mainstream computer graphics performance. Neither company has announced details about how these new integrated architectures will achieve such heightened performance, but it will most likely be the result of moving the CPU, GPU, and memory controller

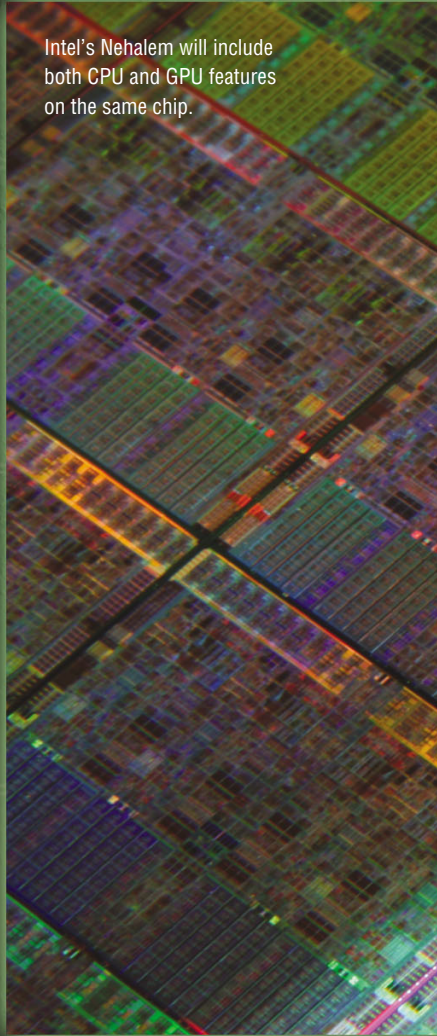
onto a common chip sharing increased parallel access to cache memory. Increases in clock rates and greater parallelism will also likely contribute to the acceleration, while a transition to a 32nm manufacturing process will help control the power requirements of such components. The AMD part will be based on the GPU technology it acquired with the purchase of ATI. Interestingly, both components will target mainstream laptops, which represent over 60% of consumer PC purchases.

A move to this architecture most likely signifies another important change in the computing world as we know it. Hereafter, it is unlikely that any next-generation game console shipped in the future will be able to outperform average mass-market consumer PCs and laptops for media and gaming performance. The laptop your kids take to school or do their homework on will have better 3D gaming capabilities, better video and audio processing, better connectivity, and of course better mobility than a dedicated game console is likely to achieve in the foreseeable future.

These architectures, which will see their first incarnations released in the second half of this year, are the first generation of a new kind of unified chip design that will enable AMD and Intel to build future chips that benefit from enormous "intrinsic" parallelism. In other words, parallelism will occur automatically without developers necessarily having to write their programs to specifically benefit from it. These chips will no longer be monolithic processors, but will instead feature mix-and-match cores composed of any combination of CPU cores, GPU cores, video cores, and shared memory caches to produce a range of chip permutations optimized for demanding enterprise server applications or consumer media applications. These new chips will be faster, of course, but will also be vastly more versatile in their capabilities, freeing developers to largely ignore the intricacies of their parallelism. Once the problem of writing programs that benefit from parallelism has been abstracted from the problem of adding parallelism at the chip level, it will once again be possible

for existing applications to realize dramatic performance improvements on new processors without modification.

Rumors of Intel's fabled Larrabee chip, tentatively planned for public demonstration this year and release in 2009 or 2010, hint at even more ambitious designs for unifying the CPU and GPU into a common, highly scalable computing platform. It is rumored that each processing core on the GPU will basically be a mini x86 core coupled with an extremely powerful vector processor. The Larrabee architecture is rumored to be able to scale to an arbitrarily large number of parallel cores. A fascinating feature of this architecture is that it may well be backward-compatible with existing x86 processors, yet capable of performing all the functions of a dedicated, highly versatile DirectX GPU.



Intel's Nehalem will include both CPU and GPU features on the same chip.

Another possible feature of this architecture is that the OS or an application could dynamically assign a certain percentage of the processor to act like a CPU and a certain percentage to act like a GPU, based on the application's processing needs. To date, Intel has positioned Larrabee as a high-end graphics component targeting scientific visualization, but it seems likely that this architecture is Intel's response to Nvidia's dominance in high-end graphics cards for gaming PCs. The architecture conveniently reflects the kind of ultra-generalized GPU design suitable for a broad array of 3D and physics calculations that the graphics market has been moving toward.

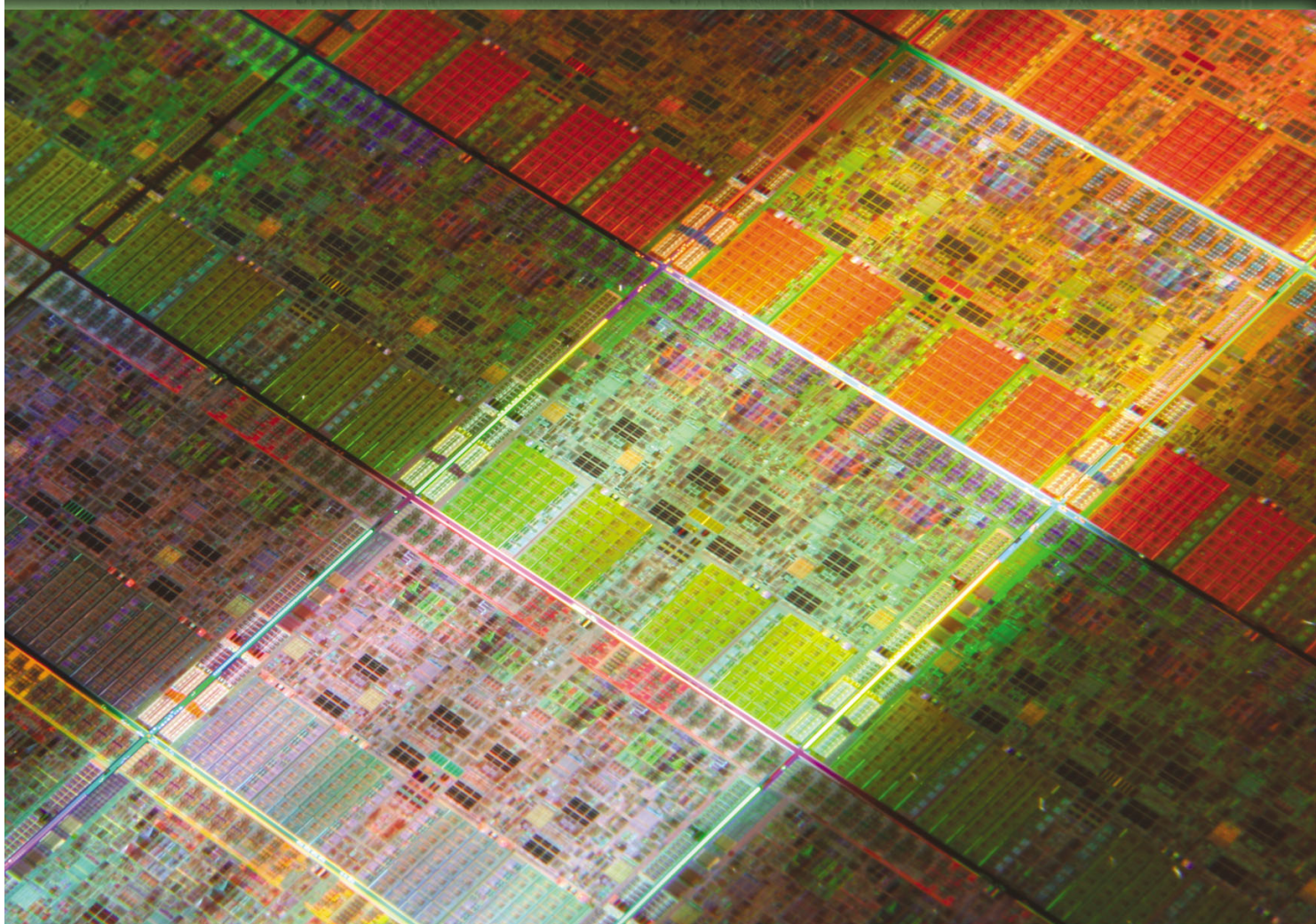
This trend in computing is very exciting because it will mean that some longstanding barriers to rapid innovation and acceleration will ultimately vanish. The transition

may be a little ugly, however, because no assembly language-level standard exists for GPUs. One of the reasons for the GPU's rapid evolution is that DirectX abstracted or hid low-level access to the graphics cards' native register sets and assembly language, thus enabling ATI, Nvidia, and others to compete with each other without being forced to conform to identical chip architectures and instruction sets. Games and game tools didn't have to change to support or take advantage of new graphics card architectures as long as they were coded to DirectX. Game developers could choose to adopt new graphics features at their leisure independently of their introduction to the market. This escape from dependence on chip architecture enabled an explosion in competitive innovation and content in GPUs. When the GPU becomes a deeply

integrated component of the CPU, the need to define x86 language extensions to embrace it will cause an inevitable conflict of "standards" between Intel and AMD, who will almost certainly have opposing visions for how this integration should be accomplished.

The good news is that a clear path through this transition exists. Both companies can introduce proprietary x86 GPU language extensions, write Direct3D drivers to support them, and pressure Microsoft to further generalize Direct3D pixel/vertex shaders in a future version of DirectX and support them with C#. Then they can let the free market sort it out as an era of highly scalable parallel software applications reaches the market. ▲

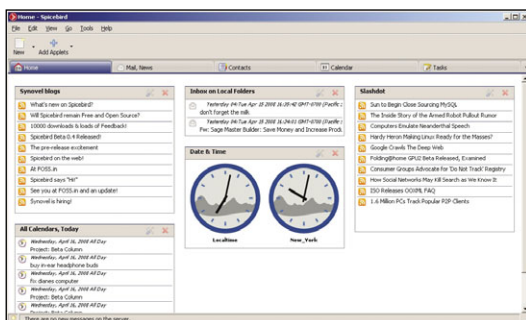
by Alex St. John



The Bleeding Edge Of Software

Inside The World Of Betas

Synovel Spicebird 0.4 Beta



Just when you thought you had pretty much seen everything that could be made with the Firefox and Thunderbird codebase, Synovel mashes up a collaboration and productivity tool that seems eerily familiar. Though very early in its beta cycle, it's interesting enough to warrant a look.

Spicebird combines the email abilities of Thunderbird, the contact management abilities of, well, Thunderbird again, the calendaring of Sunbird, and the task management abilities of, well,

Spicebird 0.4 Beta

Publisher and URL: Synovel Technologies, www.synovel.com

Developer and URL: Synovel Technologies, www.synovel.com

Product URL: www.spicebird.com

ETA: Q4 2008

Why You Should Care: Yet another useful mashup of practically all things Mozilla.

nothing quite like we've seen from the Mozilla group. Each of these main modules lives

under a tab, looking rather like Firefox with five tabs open, and the main toolbar and menu bar changes its tools and pull-down menus based on which tab is selected. Readers with math skills will note there's one more tab than modules; this houses the Home tab, which displays various bits of information on one screen from all the other modules and some extra data, too.

The Home module displays subscribed RSS feeds, a number of world

clocks, emails from your Inbox that meet the criteria you set (such as all unread less than two days old), and events from your calendar. Presumably, To-dos will be listed in the Home screen, too.

In fact, the beta has some significant problems to work around. The Thunderbird-like email module doesn't seem to create an Inbox folder, so new mail has nowhere to go unless you create one manually. The shared calendar works with iCal feeds (good), but the colors identifying different calendars' events get lost after a while (bad). The task list seems to allow for tasks to be grouped with different calendars, but it didn't work for us.

When combined with a good iCal and mail server, Spicebird has all the makings of a good groupware tool or personal information manager, but the bugs in this early beta are almost, but not quite, crippling. Clearly, Spicebird is a tool to keep an eye on. ▲

by Warren Ernst

Reg Organizer 4.21 Beta 3

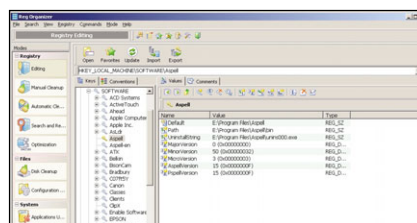
Just because Windows comes with a free utility doesn't mean there isn't room for commercial alternatives: Just look at all the disk defragmenter programs available for Windows. Similarly, while there's nothing inherently wrong with Regedit, there's certainly room for improvement, which brings us to Reg Organizer.

Reg Organizer is both a Registry editor and a suite of system-enhancing utilities and system tweakers, all within a single interface that is always clever but only usually sensible and well-integrated. The major tools have buttons running along the left side of the Reg Organizer window, and clicking them usually changes the contents of the right side of the window. Sometimes, however, clicking them pops up a large dialog box with a wizard running inside,

prompting you to perform actions step-by-step. Such wizards include Disk Cleanup (which finds "useless files" and broken shortcuts) and System Tweaks (which contains checkbox after checkbox of tweaks, such as disabling NTFS' "Last Access" flag), or Registry Optimization (which defrags the different Registry files).

The Registry editor itself is like Regedit on steroids. It can monitor the Registry during software installation and display all the changes made to it. It can jump to where most programs set their "auto-start" flags for the quick disabling of auto-startup programs. It even allows for previews for REG files before actually installing them.

After extended use and testing, it seems Reg Organizer is a beta in name only—it worked flawlessly on our systems, looks



Reg Organizer 4.21 Beta 3

Publisher and URL: ChemTable Software, www.chemtable.com

Developer and URL: ChemTable Software, www.chemtable.com

Product URL: www.chemtable.com/orga nizer.htm

ETA: Q2 2008

Why You Should Care: When RegEdit isn't doing it for you, this one probably will.

and feels polished, and even has a thorough Help file. ▲

by Warren Ernst

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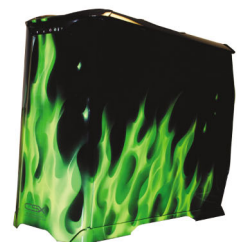
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UP TO SPEED

Upgrades That'll Keep You Humming Along

Some of the most useful software tools around get refreshed this month, including Google Earth, AIM, Norton 360, and Ubuntu. The PS3 gets a new storefront.

Software Updates

Adobe Camera RAW 4.4.1

The latest version of the RAW conversion and editing plug-in for Photoshop and Photoshop Elements supports the latest cameras from Canon, Nikon, Fujifilm, Olympus, Pentax, and Sony.

www.adobe.com

AIM 6.5

AOL's ubiquitous instant messaging client gets refreshed with a new status message that lets buddies see your current mood. You can also change the color of your Buddy List and get enhanced support for playing games in the client.

www.aim.com

Apple Safari for Windows 3.1.1

The Windows version of Apple's popular Mac Web browser receives stability, compatibility, and security improvements.

www.apple.com

Avant Browser 11.6 Build 11

The Internet Explorer-based custom browser gets a range of bug fixes. Now you can sort RSS feeds properly by date and delete old messages. You can drag and drop favicons into the address bar, as well.

www.avantbrowser.com

Google Earth for Windows 4.3.7191

The global satellite image search and mapping tool adds photo-realistic images of buildings in major cities. The Sunlight feature lets you see areas in dawn to dusk views. And now you can swoop into the street level from outer space.

www.earth.google.com

GPU-Z 0.1.9

The diagnostics tool for graphics processors corrects a blue screen problem when it launches. It also fixes the shader count for NV44.

www.techpowerup.com/gpuz

Mediamonkey 3.0.3.1159 RC2

The latest beta release of the powerful media player/manager adds a boatload of fixes. From renaming files to where podcasts get saved to ratings calculations, this new monkey squashes many bugs.

www.mediamonkey.com

Microsoft Malicious Software Removal Tool 1.40

Microsoft's virus and worm removal tool targets the most recent and common malware. The new version keeps the virus profiles current.

www.microsoft.com

Norton 360 2.0

Norton's full-service security super-suite is updated here with much smoother support for various versions of Vista. A network monitor and manager complements the feature set and lets user see other PCs using the network and tweak their access.

www.symantec.com

Paint.NET 3.30

The open-source image-editing and paint program gets another update, but this one has cool new features. You now can save PNG files in 8- and 24-bit depths and BMPs in 8-bit. An auto-detect bi-depth option determines the lowest depth that can still save the image without quality loss.

www.getpaint.net

SiSoftware Sandra XII 2008 SP2

The latest update for the classic benchmark and diagnostics tool gets new comparison views of performance vs. speed vs. power vs. price. These and other comparisons are designed to help users decide on upgrades. Also new are wireless performance measures and tools for determining bang-for-buck upgrades.

www.sisoftware.com

Ubuntu 8.04 RC

The latest iteration of the popular open-source Linux OS includes the GNOME 2.22 interface with a new file manager. The release candidate is based on the latest Linux kernel 2.6.24, which brings better AMD64 support and a new process scheduler. A new PulseAudio sound server lets you mix audio from several applications.

www.ubuntu.com

Xfire 1.90

The communications engine for online gamers gets a Remote Video option in the Videos tab and fixes problems with uploading video. Video capture now can save files larger than 2GB.

www.xfire.com

Driver Bay

ATI Catalyst 8.4

For Radeon cards, this driver update fixes Vista problems with Crysis, Hellgate, and Tabula Rasa. The Catalyst drivers no longer freeze Vista when using Auto-run in Overdrive. Windows XP no longer suffers a performance drop in 3DMark05/06.

www.amd.com

PlayStation3 2.30

New firmware for the PS3 brings a radical revamp of the PS Store. The interface has been updated to give users more direct access to the content catalog. There are also video previews of games.

www.us.playstation.com

by Steve Smith

Big on Performance, Thin on Lag.



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Siber Systems GoodSync 7.1.6

If you use several devices or network locations for storage, an application that performs both synchronization and automated backups can save you a lot of time and effort. GoodSync is a full-featured synchronization and backup utility that lets you move files between hard drives, LAN locations, and external storage devices, as well as over SSH, FTP, and WebDAV-based systems. You can even configure GoodSync to copy or sync data upon login or upon the connection of removable storage.

The GoodSync interface splits the screen into two sections, and each side presents a detailed list of the folders and files in their respective locations. In the middle of the split screen, each file offers a Right To Left, Do Not Copy, and Left To Right icon, so you can make quick changes to the files involved in a transfer. If every file needs to move in the opposite direction, you can select Swap Job Sides to reverse the original and backup destinations. A backup utility

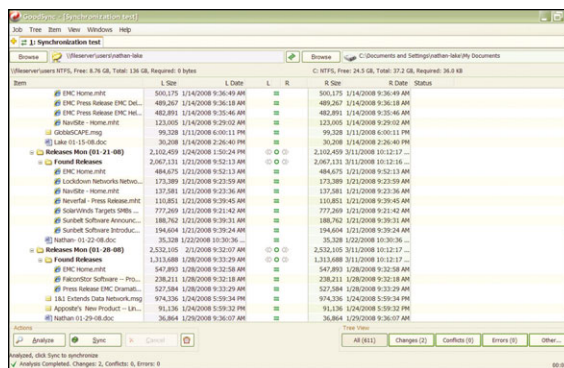
wouldn't be complete without an automatic scheduler, and GoodSync can automate file changes by the minute or hour, or utilize timetables in Windows Task Scheduler.

In terms of synchronization, we like that you can exclude files based on definable criteria, such as by folder, by file name, or by file extension, to let you block the transfer of files you want to keep isolated. GoodSync also keeps a log of actions and changes, so you can track when your devices were last synchronized. For those who like to sync or back up to multiple locations, GoodSync can run several transfers simultaneously.

GoodSync's combined ease-of-use and feature set allow you to automate the sync and backup of nearly all of your storage tools, whether online or physical storage.

There's a free 30-day trial, so give it a shot to see if GoodSync meets your sync and backup needs. ▲

by Nathan Lake



GoodSync 7.1.6

\$19.95

Siber Systems

www.goodsync.com



Serif WebPlus X2

Web experts who want to create a functional, multimedia-rich Web site fire up a text editor, roll up their sleeves, and start coding. WYSIWYG editors are tools intended for noobs looking to slap together an ugly Web site, right?

Not if those noobs use WebPlus X2. It's rare to find a relatively inexpensive product that lives up to all its claims, but this software allows for the creation of truly stunning Web sites without requiring end-users to know HTML from a hole in the ground. It works like a slick piece of print layout software, letting users layer and arrange any combination of shapes, pictures, text boxes, and other elements they like while automatically generating the underlying code with a minimal amount of bloat.

Granted, the code it produces isn't pretty, but it's still editable, and you can insert code snippets of your

own without looking at the source code at all. This is fantastic for adding something like a Google Map or Google Calendar to a site, as you can size a box that matches the size of the element you want to insert, paste in the code, and then modify that snippet directly without disturbing anything else.

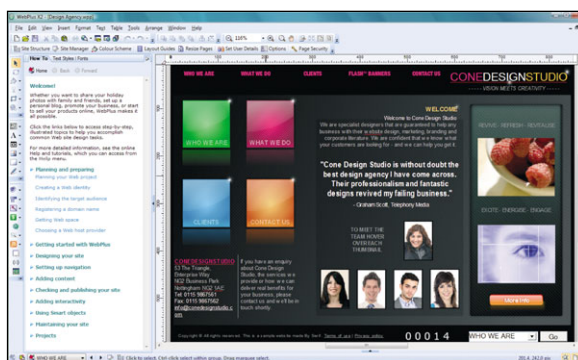
We whipped up a community site from scratch within a few days, creating most of the graphical elements using the tools built into the software and then adding pictures from an external image editor. The layout in WebPlus always matched exactly with

the resulting page when previewed in Internet Explorer or Firefox, and publishing everything was trivial.

The program comes with a number of templates to get you started, but it's just as easy to create a layout using an image editor, slice it into pieces, and then use WebPlus' excellent drag-and-drop interface to arrange everything to your liking.

WebPlus X2 may not offer the coding control that programmers crave, but this isn't for them. It's a tool that lets creative people with no technical expertise create sites that don't look or act like they were spit out of a WYSIWYG editor, and it lets them do it without breaking the bank. ▲

by Tracy Baker



WebPlus X2

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www.serif.com



Battle Of The Browsers

Finding An IE Alternative Isn't The Problem; Choosing One Is

Is there any software other than an operating system that is used more than a Web browser? No matter what else you're working on, playing, or fiddling with, there's always useful information just a few clicks away on the Web, so it pays to use a browser that works with you instead of against you.

Internet Explorer may still dominate the browser-installed base, but in the world of software, market share is often inversely proportional to utility. It's not that IE is terrible—the latest versions are actually pretty good—it's just that there are many superior alternatives, and thanks to the browser wars of yesteryear,

all of them are available for free. We tested several of the best IE alternatives and also took a look at the Internet Explorer 8 beta to see how things are shaping up and help determine which browser best serves your needs.

Firefox 3.0b5

Even though it was still in beta when we tested it, Firefox 3.0b5 proved to be rock-solid, and it has far more features than does the previous version. It's also lightning fast. Loading is practically instantaneous, and page rendering is speedy even at sites laden with embedded multimedia.

The new interface looks great (finally, a Back button that's bigger than the rarely-used Forward button), and a new password management bar and download manager makes those tasks easier than ever. The bookmark system has had a complete overhaul, as well: stars appear in the address bar that automatically create (or remove) bookmarks when clicked, and you can tag bookmarks with various keywords for advanced sorting. One of the best new features is the ability to associate your Web-based email with mailto links in Web pages—in previous versions, they only worked with locally-installed email clients.

As always, Firefox's most useful feature is the access it provides to a staggering variety of useful extensions. It seems that no matter what Web services you use or what preferences you prefer when surfing the Web, there's likely an extension that

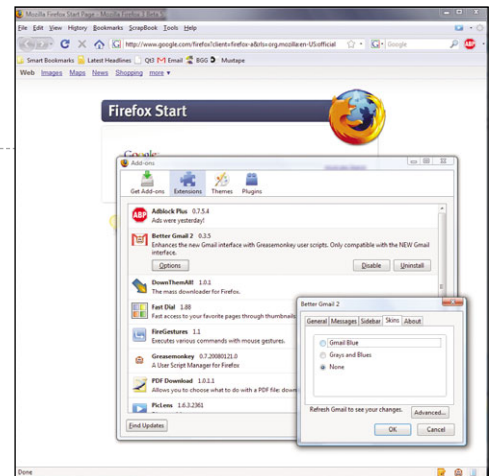
Firefox 3.0b5

Free
developer.mozilla.org



caters to your whims while adding features you never even dreamed about. We added a few dozen to the beta, and doing so didn't affect the program's launch time at all. Some extensions, such as the fantastic Ad-Block, actually sped up surfing by virtually eliminating advertisements from sites. Best of all, each extension comes with its own configuration options, allowing for the type of deep customization that people who rely heavily on their Web browsers need.

Unfortunately, extensions still prove to be Firefox's biggest weakness. It's easy to go crazy adding them, creating a Frankenstein monster that consumes a ton of resources and frequently collapses under its own weight. Another problem is that the browser is updated so frequently that extensions you come to rely on tend to break when the latest version of the browser is installed. Extensions are often updated quickly to compensate, but Firefox users are frequently forced to



decide if they want to check out the latest version of the software or stick with an older build to maintain support for their precious extensions. Of course, it's also possible to run multiple versions of Firefox as long as you maintain different installation folders for each one, so you can enjoy the best of both worlds with a little bit of juggling.

The benefits of using Firefox aren't always immediately apparent, but use it for a few months as your main browser and switching to something else will seem insane. This is especially true if you

use some of the more advanced extensions. Greasemonkey is a good example because it lets you use scripts to completely change the look and feel of many Web sites, streamlining them or making

them more convenient to use. Tons of premade scripts that plug in to the extension are available at userscripts.org, and after applying many of them, accessing sites such as Gmail in a different

browser felt like going back to the Stone Age. With version 3, Firefox has truly evolved from an IE alternative into a standards-setter that works marvelously as a primary browser.

Opera 9.27

Opera is such a good browser that, until recently, a lot of people were willing to pay for it, and for good reason. It's fast, packed with useful features, secure, and highly configurable without demanding a huge chunk of system resources.

Speed Dial, one of 9.27's major new features, had the potential to be gimmicky, but by the end of testing, we ended up wishing it was standard in all Web browsers. It acts like a "best of" bookmarks list, providing single-click access to nine of your favorite sites anytime you create a new tab. Each entry gets its own thumbnail picture, making it easy to quickly tell them apart, and it's very convenient to have a short list of the sites you access most often separate from your entire bookmarks list.

Opera has an integrated BitTorrent client that works in conjunction with a built-in peer-to-peer file manager to make it easy to work with torrent files. Scripting is also supported, meaning Opera is compatible with most of the scripts written for Firefox's indispensable Greasemonkey extension.

The built-in mouse gesture support is arguably the best of its kind. It includes handy link gestures that let you open links in new tabs by placing the pointer over them, holding down the right mouse button, and dragging down to open the link in a new foreground tab or down and then up to open it in a new background tab. There are also wheel

Opera 9.27

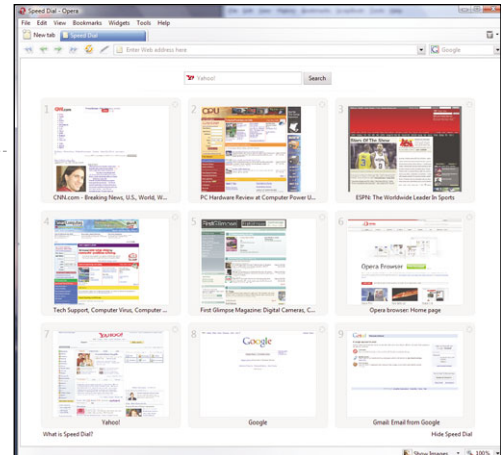
Free

www.opera.com



gestures, which use the mouse wheel in conjunction with the SHIFT and CTRL keys to let users do things quickly, such as browse through a tab's history or zoom in and out. Many more gestures are included, and all are extremely responsive without needing to draw ugly trails all over the screen.

There's no doubt that Opera is superior to Internet Explorer in nearly every category, but choosing between it and Firefox makes for an agonizing decision. Firefox has a huge community that cranks out tons of extensions, including an Opera-like Speed Dial option, meaning it can be tailored to meet nearly anyone's needs. Opera may not boast that sort of expandability, but its features are much more tightly integrated than those supplied by Firefox extensions. Choosing between the two is like shopping for cars—do you go with the stock luxury model (Opera) with the smooth ride or opt for the economy model (Firefox) and bolt on a ton of aftermarket parts that may not work well together and require frequent maintenance? Most power users have enough expertise that Firefox is the clear choice, but don't sell Opera short. It's a stable powerhouse that doesn't need a lot of extra chrome to serve as your main Web browser.



We also looked at the latest Opera beta (9.5 beta 2), and it makes several improvements over the 9.27 release. Like Firefox 3, it loads in the blink of an eye, and it also renders pages a bit faster than the release version does. Better still, it handles grueling standards tests such as Acid3 (acid3.acidtests.org) better than any other browser we tested. That means it's poised to offer terrific compatibility with sites using the latest tech.

A few tantalizing new features are also included, our favorite being Quick Find. If you ever remember something mentioned at a site but can't remember the site's name, you can type a keyword into the address bar and a list of every page you've visited that has that word on it appears. This is a god-send for forum dwellers who can never recall the thread where something interesting was discussed, and Opera 9.5's official release should provide a worthy alternative to Firefox 3.

Safari 3.1.1

Minimalists of the world rejoiced when Safari finally found its way from the Mac world to Windows. The skin's frame is so thin that Safari looks like a svelte supermodel next to its chunkier competitors.

Safari uses small text in the menu bars instead of loud icons. Everything's rendered in grayscale, and like most Apple products, it just looks tasteful.

In some ways, form supercedes function, as the sides of the frame are so thin they are difficult to grab with the mouse

for resizing. The default text setting makes every word look like it's written using a Magic Marker—don't they know that most of us already use ClearType to smooth text? No matter what setting we used, text never appeared as sharp and smooth on our test LCD using Apple's

browser as it did using Windows' Clear-Type in other applications, and it would be nice if Apple would just let the OS take care of things.

This is certainly a fast browser—a bit slower to launch than the Firefox 3 beta, but as fast or faster at rendering most pages. Compatibility is another strong point. As long as the page doesn't contain something proprietary such as ActiveX, Safari usually handles it with aplomb, even if the site doesn't detect it as a compatible browser. For example, when we logged in to Yahoo! Mail using the browser, the service suggested we use the Classic version, but the newer version of Yahoo! Mail worked just fine. Web coders will want to enable the Develop menu entry to access a boatload of debugging tools.

Safari 3.1.1

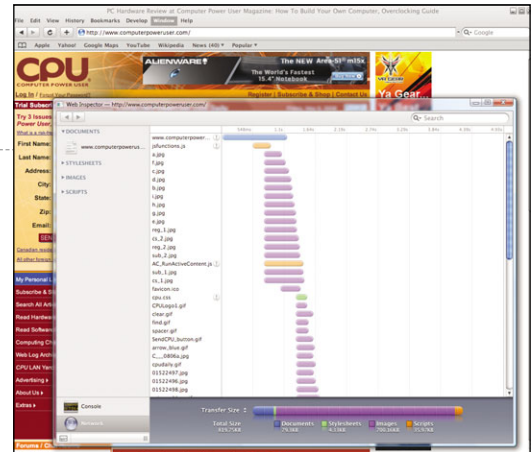
Free

www.apple.com/safari



Safari's real strength is its Bookmarks Bar, which efficiently organizes your bookmarks, browsing history, and RSS feeds using an interface reminiscent of iTunes'. The integrated RSS reader is just as slick as the rest of this package and uses an article-length slider bar that lets you collapse every entry to a single headline or slowly expand them to reveal detailed information and thumbnail pictures.

Classy as it looks, Safari is too barebones to suit the needs of most Web



power users. The competition could take a few cues from its muted interface, but beyond that, Apple has a lot of catching up to do.

Flock 1.1

There's no liking or disliking Flock—you either fully embrace it or uninstall it in disgust after five frustrating minutes. The side you choose depends on whether or not you depend on the Web as a social tool, as well as the social networking sites you use.

Flock is more a Web aggregator than a Web browser, with a focus on popular social meccas such as Facebook, Twitter, and LiveJournal. File-sharing services such as Picasa, Flickr, Photobucket, and YouTube are also supported, and a Media Bar provides quick access to all your preferred newsfeeds. The browser is based on the same code that powers Firefox, so if you do decide to use it, you can benefit from many of the things that make Firefox so great.

The heart of Flock is the My World page, which pulls all your Favorites, feeds, social site activity reports, and online multimedia into a single, highly organized page. This is fantastic if you and the people you know use some of the 18 Web services that Flock supports, but others, such as MySpace users, must access their preferred social circle the old-fashioned way.

Despite its social leanings, Flock actually has a decent research tool in its Web

Flock 1.1

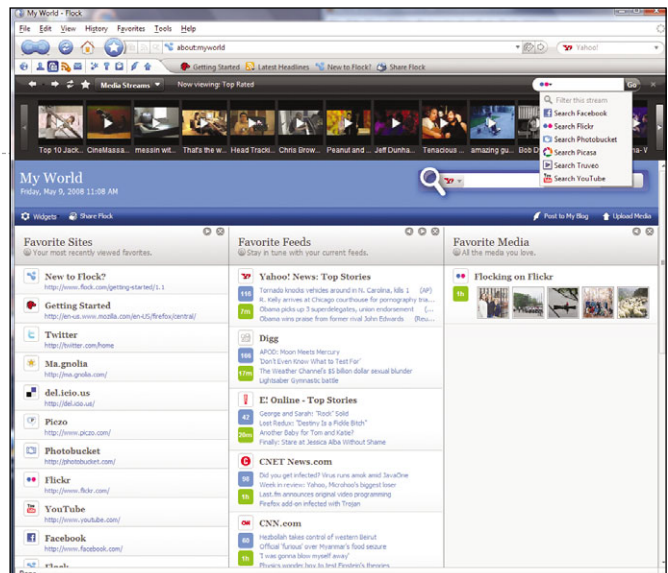
Free

www.flock.com



Clipboard. It opens a sidebar where you can drag and drop anything you like from a Web page—graphics, links, or highlighted text—for later use. Each entry is kept separate (and you can create folders for different topics) and includes links to immediately view, email, blog, or delete it. This feature is fantastic for times when you want to follow up on something you read in a blog or Web feature but don't want to clutter up your Favorites list with junk you likely won't use or remember several weeks later.

One of the problems uncovered during testing is that Flock supports Gmail to handle email chores, but we couldn't get it to use a Gmail account via Google Apps. A bit more customizability to get around problems like this would be appreciated, but the supported services



are integrated so tightly into Flock's interface that it's understandable why users can't force the browser to support any site they wish.

Overall, Flock provides a nice bird's-eye interface for tracking multiple social networks and newsfeeds simultaneously. We wish every browser had something equivalent to Web Clipboard, but beyond that, we ended up using Flock as a standalone app for tracking our social circles while relying on more streamlined products such as Firefox and Opera as primary browsers.

IE8: Beta Than Ever

Microsoft doesn't often release full-on new versions of Internet Explorer, and IE8 is shaping up to be very interesting based on the beta. The browser is tightly integrated with Microsoft's range of Live services (Live Spaces, Live Maps, and Live Mail are just a few examples), so its overall success and usefulness will either depend on their success or propel them to it.

Even in beta form, IE8 renders pages much faster than IE7 does and often seemed just as zippy as Firefox and Opera during testing. Although it didn't fare as well as many of the other browsers in the Acid3 test in day-to-day browsing, its ActiveX support made it compatible with a great number of sites that Firefox, Opera, and Safari can't handle. Here's a graphical view of the major features included in the current beta version.

WebSlices

Just as we now have news-feeds, WebSlices lets you

WebSlices lets you monitor specific bits of dynamic Web page content directly from the IE8 interface, without having to load the related page.

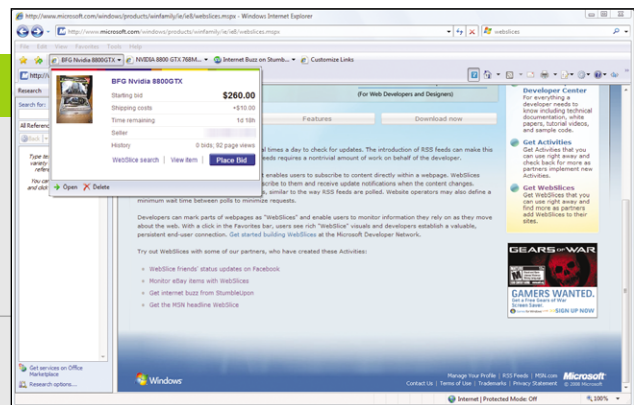
subscribe to other types of content in a Web page—such as an auction listing—and keep tabs on it in the IE interface instead of having to revisit the page.

Activities

Highlight any text on a page, right-click it, and an activity button appears that provides access to a drop-down menu. Items added to the menu let you directly interact with the selected text in various ways, such as running an eBay or Facebook search in a pop-up box without having to navigate away from the page currently being viewed.

Developer Tools

Web coders should be pleased with this feature that



breaks source code into HTML, CSS, and Script tabs for perusal and debugging.

Toggle IE7 Emulation Button

This is nice for guaranteeing compatibility but isn't as slick as it could be. You must close and restart IE to initiate the emulation and can't quickly do it on a page-to-page or site-to-site basis.

Research Bar

Look up text while you're writing that paper via a dictionary, thesaurus, the Encarta encyclopedia, or any number of other sources (but where's the Wikipedia option?).

Add-Ons Manager

Easily search for plug-ins that enhance IE8's functionality, but be aware, most of them are commercial apps, so don't expect to trick this out like you would with Firefox.

Safety Filter

This tool takes care of IE8's antiphishing chores, which keeps your data safe.

There's No Place Like Home Home Home

By typing URLs on separate lines in the Home Page box, you can have IE8 automatically open multiple sites in multiple tabs each time it launches.

When IE Is Not IE

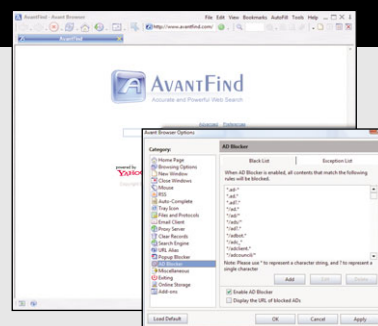
Although this article focused on alternatives to Internet Explorer, there are several browsers based on IE that provide that product's excellent compatibility with a much more sophisticated feature set. We tested several for this article, and two stood out as interesting options if you simply must use IE.

Avant 11.6

The default install of Avant is somewhat annoying, with the integrated ad blocker playing a sound and popping up a list of blocked URLs on each

page, but dig into the options menus and you'll find that it's easy to bend the software to your will. There are customizable mouse gestures, shortcuts for using different search engines, and tons of other options. Even reconfigured, the ad blocker isn't the best we've tested by a long shot, but it's still better than the simple pop-up blocker that comes with IE. An RSS reader is also included.

One of the most interesting features is Avant Online Storage, a free service that



Avant 11.6

Free
www.avantbrowser.com

stores all of your configuration info, subscribed newsfeeds, bookmarks, and passwords so you can access them from anywhere. The files are encrypted, although Avant doesn't provide much detail regarding the method used, so if you have

qualms about including your personal info in the online backup, be sure to access the browser options page, click Online Storage, and remove the AutoFills check mark.

While we still prefer Firefox or Opera, Avant's interface

Netscape Navigator 9.0.0.6

Netscape Navigator 9.0.0.6

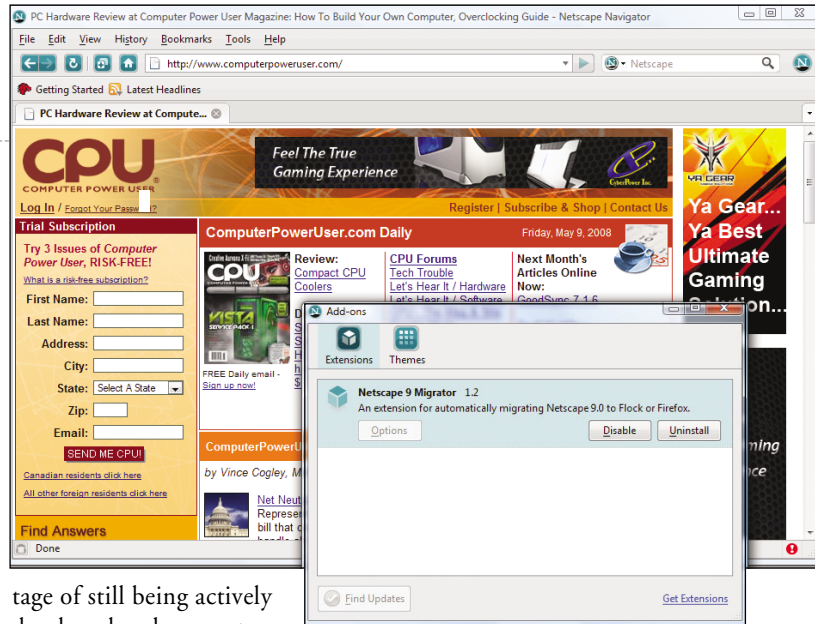
Free

browser.netscape.com



All good things must come to an end, and official support for Netscape Navigator ended March 1, 2008. This vet of the browser wars had a great run that ended with a whimper in version 9.0.0.6, which is overshadowed and overmatched by its spiritual successors.

Navigator is based on the same engine as Firefox and is compatible with Firefox 2.0 extensions. It also integrates a great number of social networking features, but they are only useful for those who are part of the Netscape.com community. Firefox does the extension thing better, Flock does a better job handling the social aspects, and both of those browsers have the decisive advantage of still being actively developed and supported. Navigator is officially dead, and unless you are a user of Netscape.com's



services, it's time to pay your respects and move on.

The Envelope, Please

Although everyone is encouraged to try Opera if you haven't already, Firefox 3—even in beta form—is the clear winner for power users. Never mind its incredible speed or improved interface, because even if it were slower or uglier, its support for

hundreds of useful extensions would still cement its top position. Need to view a page designed only for IE? Use an extension such as IE Tab to take care of it. Can't live without Opera's Speed Dial? Install the Firefox extension of the same name that does the same thing. Practically

nothing is beyond Firefox's reach, and new extensions can quickly take care of any future weaknesses that crop up. We can't wait to see how the final release version turns out. ▲

by Tracy Baker

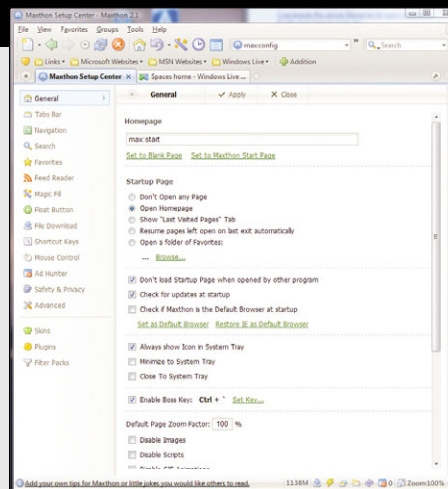
enhancements, customizability, and other features are more than enough to make this worthy of a look if you want an IE-based browser.

Maxthon

The selling point of Maxthon is interface customizability. It's easy to reskin for a quick new look, and you can easily add, remove, or rearrange interface elements just by dragging them around. Mouse gestures are fully integrated, and you can drag links and drop them in the tab bar to quickly open them in

a new tab. It's also possible to assign custom commands to each gesture if you don't like the default settings. For those who prefer to drive their browsers using nothing but the mouse, Maxthon is nearly perfect.

An ad blocking application is built in and works OK out of the box, although it missed several ads that our Firefox ad-blocking extensions killed. Fortunately, custom filtering is



Maxthon

Free

www.maxthon.com



and configuration options for the browser itself are much more sophisticated than those included with a vanilla IE install. Maxthon may look a little bit messy when you first launch it, but it takes just a few

minutes of tweaking to get a browser that works better than the one on which it is based. ▲

Dialogue Box

by Chris Pirillo

The Power Of Less Power

My little brother made me feel like a very older brother when he and his wife gave birth to my first nephew, Zander. I couldn't wait to see videos of the world's newest Pirillo, but all I got was a small set of JPEGs that had been resized to a paltry 640 x 480. Don't get me wrong, I was happy to receive anything at all, but I couldn't figure out why my extended family's technology was seemingly stuck in 1998!

"We have a video camera," my brother claimed. "It's just difficult to do anything with those tapes." Ain't that the truth.

Despite my extreme desire to help them document their child's earliest moments, I didn't want to intercede with a solution that would yield nothing but consternation. Sadly, most of the video-digitizing solutions are kludgy at best. Instead of suggesting an over-the-top digital video recording package, I gifted them a Flip Video camcorder, which has gained a fair amount of praise for its portability, affordability, and extreme simplicity.

Even for a power user, sometimes "good enough" is more than enough. It's not always easy to recognize that line, however. How many times have you recommended something for someone else because it's what *you* wanted, not what *they* needed?

The next hurdle to overcome was their home computer, a five-year-old laptop that was likely running short on space (and speed) by today's standards. I offered to assemble them a new system with some of my extra equipment, and they welcomed the opportunity. How else could I do live videoconferencing with them from halfway around the country? Yeah, they needed a Web cam, too.

It was a dark and stormy night (a given here in Seattle). I executed Darik's Boot and Nuke (dban.sourceforge.net), then proceeded to reinstall Windows XP onto an OEM PC. Finding the drivers proved to be somewhat of a nightmare, but better that I experience that than someone who doesn't care how his system works, so long as it does work without much fuss.

When all the Windows updates had been installed, I had to think about what other

software they might want and/or need on the computer. For videoconferencing with friends and family, Skype was the answer. For managing digital photos and videos, I installed Google's Picasa. For editing documents, spreadsheets, and presentations . . . I got stuck.

Why should I install Microsoft Office if I know this family won't use 90% of what it offers? I could, instead, give them OpenOffice and call it a day. That may have been my ultimate decision, if it weren't for

the fact that Google Docs is more than sufficient for their needs; I didn't install anything but a shortcut to Google Docs.

Certainly, many desktop productivity tools are far more powerful than their Web-based counterparts. But that doesn't make the least powerful application any less powerful in context. For my brother and sister-in-law, the ability to access and edit the same files from home or work is priceless (literally and figuratively). Who knows what kind of software they'll choose to put on the computer over time, but at least I could illustrate to them the concept of finding more power in having less power.

As systems evolve and grow more complex in nature, I find the need for simplicity to increase in kind. Imagine if someone handed you the world's most complete pocket knife with every single blade exposed and extended. Would that not overwhelm and diminish the immediate usefulness of the tool?

As power users, we seek out new experiences with hardware and software and enjoy the journey as much as we do reaching the destination. We love bells and whistles, but shouldn't we love a well-placed bell over a million haphazardly implemented whistles?

Zander's quite lucky: He gets to grow up in a world that is becoming increasingly connected, increasingly digital, and filling up with increasingly friendly technology that just works. Maybe you'll think less of me to assert that the complexity of technology has overstayed its welcome, but I believe it's true.

Who really needs life to be more complex than it already is? ▲



Chocolate rain, Chris Pirillo's thoughts do wax and wane. Chocolate rain, others find him to be quite insane. Chocolate rain, making people laugh by singing "Penny Lane." Chocolate rain, Google him and you will fan the flame. Chocolate rain, bylines written like this aren't the same. Chocolate rain, fingers point to Chris, we shift the blame. Chocolate rain, we don't understand, we can't explain. Chocolate rain, will you read this article while on the train? Chocolate rain, please don't squint to read, it causes strain. Chocolate rain, are you tired yet of this refrain? Chocolate rain, fine, we're done for now, so no more bane.

You can dialogue with Chris at
chris@cpumag.com

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The Sky Is Blue

ZOMG! I'm still LOLing, if not actually ROTFing, over the huge reaction to a Red Hat Desktop Team blog posting noting that Red Hat has "no plans to create a traditional desktop product for the consumer market in the foreseeable future." Their excuse: It's tougher to turn a profit selling a consumer OS than it is to sell server and other enterprise software (like Red Hat Enterprise Linux Desktop).

Doesn't anyone remember 2003, the year Red Hat stopped selling their "traditional desktop product for the consumer market"? You could buy Red Hat Linux in a shrink-wrapped box at Staples or Circuit City for less than \$50 (if memory serves), until Red Hat pulled the consumer version and began selling Red Hat Enterprise Linux to big companies for real money.

It's tremendously expensive (and risky) to market a consumer OS unless you already have a near monopoly and long-standing deals with virtually every single PC manufacturer (except for Apple, OK?). There's only one company that does it. (Hint: It rhymes with "Nicrosoft.") As the Red Hat Desktop Team people explained, a commercial consumer Linux doesn't make financial sense. Not now, not five years ago. Maybe in the future, but there are already some fabulous Linux distributions (I'm looking at you, Ubuntu) that are freely available and widely used.

I can imagine a commercial Linux distribution that I'd pay for: a consumer Linux that can run the "missing applications" (stuff like Quicken, Photoshop, iTunes, Flash, Dreamweaver, etc.). I'm sure lots of people—most of them already using Linux—would pay for it. The question is, how much? I'd balk at paying much more than \$100.

Microsoft gets much less than that, per license, but they spend less than a commercial Linux vendor would have to. When Red Hat was selling a consumer OS, they offered user support, created packaging, fought for retail shelf space, and gave big discounts to get into the channel. On top of it all, a commercial Linux vendor still wouldn't be competing against Windows so much as against all the other Linux distributions, most of which are available at no charge.

Besides, what kind of upside can a consumer Linux vendor expect? A handful of such vendors (Mandriva, Novell/SuSE, Xandros) already exist; just how well are any of them doing?

Microsoft's almost complete desktop OS domination yields big benefits . . . for Microsoft. Here's how it works for Microsoft: Windows lock-in means that once Windows is your desktop OS, you must buy Office to get anything done; then, you must buy Windows and Office upgrades when they come out. More important, though, is that Microsoft's global OS monoculture is a feature, sold heavily to Microsoft's heavy-duty enterprise customers signing off on multi-million-dollar deals. Microsoft's server and enterprise software is better, they'll tell you, because it works best with all those Windows clients out there.

That monopoly is so valuable to Microsoft that they'll practically give away a desktop bundle (Windows, Office, and more) for a mere \$3. That's just for elementary and secondary students, available only to governments of developing nations through the MSIS (Microsoft Innovative Students) program, but it shows how low Microsoft can drop its prices when it feels threatened (as it is by pirates in those developing nations).

When you think about it, selling a consumer OS doesn't seem to be a very profitable business to be in. I imagine it might even be easier for Microsoft to turn Windows into a free (no-cost) download and allow users to install it on as many PCs as they like. After all, it's already perceived as free since it's bundled with almost every new PC (and has been forever). The downside for Microsoft would be more antitrust litigation, but they've dealt with that before.

Does the high risk and low expected profits of selling a desktop OS mean desktop Linux, or Red Hat, are in trouble? Not at all: What Red Hat's prudent reluctance shows, yet again, is that Linux is a threat to Microsoft's Windows franchise and that Red Hat is becoming a threat to Microsoft's enterprise software business. ▲



*Pete Loshin publishes
LinuxCookbook.com, a place to learn
even more about Linux. And don't
forget to check out the new
Ninitata.com,
Pete's family-friendly fun and
learning site.*

**You can get saucy with Pete at
pete@cpumag.com**

Do You Hulu?

Big Media's YouTube Killer

Back in 2006, video-sharing sites such as YouTube and peer-to-peer torrents were making a free lunch out of the expensive TV and film content from major media companies. Pirated episodes of “The Office” and the best excerpts from the previous night’s “Simpsons” showed up almost immediately on these services, where users enjoyed prime time programming without commercials. The TV networks seethed. Some, such as Viacom, sued YouTube. Others, such as ABC and NBC, started pouring their prime time shows onto network portals that offered viewers content but lacked YouTube’s ability to aggregate and search across different providers.

Enter Hulu. When it was announced in early 2007, the online video hub was dubbed big media’s “YouTube killer.” In an unprecedented joint venture of two on-air rivals, NBC Universal and News Corp. (Fox), the companies designed Hulu to fight the on-demand video-sharing phenomenon by leading it into new territory. Here, viewers could get full episodes of scores of current TV shows on demand, but also in consistently high-quality formats that are supported financially by advertising. At its formal launch in March, the site hosted over 250 TV series, from last night’s “30 Rock” to last century’s “Twilight Zone.” CBS and ABC have not yet agreed to partner with the site, so it’s not surprising that Hulu.com is heavy with NBC and Fox properties. It also has 100 feature films, Warner Bros. shows, and NHL and NBA sports programming. The catalog is a blend of full episodes and excerpts or short highlights.



After initial skepticism over big media trying to out-tube YouTube, many critics were won over during the site’s six-month private beta period. At its recent launch, Hulu had buzz and a lot of early respect. The week after its debut, traffic measurement company Hitwise ranked it 13th in terms of market share among video sites, although it dropped to 18th the following week. NBC chief Jeff Zucker reported that the site has sold out all of its advertising space for the time being. While no one at Google’s YouTube is shaking in their boots quite yet, everyone has their eyes on one of the

most ambitious Internet projects of the past few years.

“Trivially Easy”

Unlike dweebier media-sharing sites designed for the tech-savvy user, Hulu targets couch potatoes who love their remote controls. “We wanted to make sure the site was trivially easy to use,” says Hulu CTO Eric Feng. “They click on a button and immediately watch videos.” In fact, that is pretty much what happens at Hulu. Upon entering the site, users can browse and view content from the scores of studios and TV channels. Clicking any thumbnail brings up a widescreen Flash-based viewer that starts running the chosen clip or TV episode.

The first thing a Hulu visitor notices is that this is not your teen kid’s YouTube player. While the video quality is still fairly fuzzy (especially in full-screen mode), a number of cool tools pop up around the playback window. Most notably, a “pop out” option pulls the video out of the browser window into its own small screen that displays a program on the Desktop, much like a picture-in-picture window. The main browser player is lush with novel options. The progress bar lets you jump quickly through a show, and it has pop-up thumbnail images of key scenes, much like chapter thumbnails on a DVD. If you are a registered member of Hulu, the service even remembers your viewing history. When you revisit your history and restart a partially viewed TV episode, for instance, Hulu picks up the show where you left off.

Much of the usual social media apparatus is here. Users can erect



profiles of themselves to be part of a community, although at this early stage there doesn't seem to be much functionality built around the community. Hulu-ites can email links to favorite

When select prime-time episodes finish airing in the westernmost U.S. market (Hawaii), they become available for replay on Hulu.

shows and subscribe to programs so that each new episode automatically goes into the queue of unwatched programming. A custom RSS feed keeps you apprised of updates to the queue. Critic and media design researcher Mike Bloxham complained in his recent review that Hulu's interface is bland and text-filled, especially

in the relentless catalogs of show titles. "With Hulu's homepage setting up an expectation of a rich and visually engaging experience, such a drab and unimaginative interface is something of a let-down," he says.

Indeed, Feng admits that creating a usable navigation interface for such a deep, diverse catalog of content has been challenging, and it was one of the pieces that evolved most over the course of the six-month private beta. Now, you can filter the catalog at the top level by popularity, recently added content, and ratings, but then narrow that filter by applying content types (TV shows, clips, etc.) and then genre (action, comedy, etc.). That way, a user can gather results like the most recently added documentary full

"CHASE-THE-SUN" PROGRAMMING: Hulu CTO Eric Feng

Q&A

From the time Hulu's CTO Eric Feng and CEO Jason Kilar joined the project in early July 2007, Hulu's development team had only a few months to push out a usable beta of the ambitious service. Feng, a Microsoft veteran and co-founder of Beijing-based video annotation service, Mijiti, walks us through the sophisticated engine, and diverse development team, behind Hulu.

CPU: How was Hulu built so quickly?

Feng: We leveraged a lot of rapid development techniques. We used some very nice scalable frameworks like Ruby on Rails. We also have development centers in Beijing, China, and a great team here in Santa Monica. Between the two, we were able to do true 24/7 "chase-the-sun" development. The player was written from scratch, mostly in China, using ActionScript 2 to support Flash 8 and above.

CPU: When a major media company builds a player for copyrighted content, it needs to do more than play video.

Feng: It has to do a lot of interesting things around auditing. For guild restrictions, we have to show certain information while we play the video content. For the advertising, we have to track certain clicks and pieces of data as the user watches the advertisement. Building it on top of Flash enabled that because they have a very rich XML Web service layer that we can plug in to communicate with our server.

CPU: Speaking of servers, how are you able to transcode and deliver so much high-quality video so seamlessly to masses of users?

Feng: I am so happy you are recognizing the blood, sweat, and tears no one else sees. Content ingestion, workflow, and management is a huge component of that. Certain businesses send us

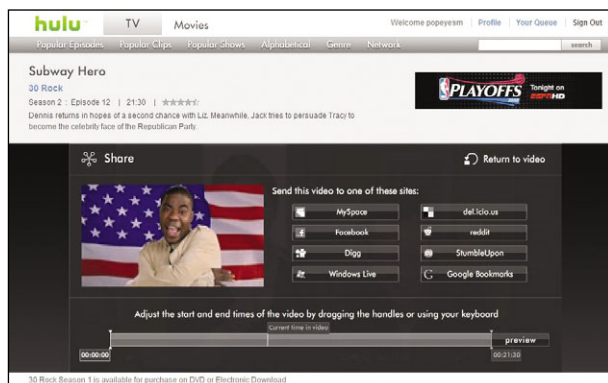
MPEG files; some send us tapes we have to transcode ourselves. It is a very heterogeneous input. We have two versions of every single video file, one at 480Kbps and the other at 700Kbps. Every bit of video content is [encoded as] On2 VP6, and in addition, some videos are in H.264, which is primarily used for the higher bit rate stuff. We have over 100 feature films, and a large percentage of those are now available in a higher-definition 1Mbps encoded at true 480p, which maxes out what you can achieve in standard def.

CPU: How about delivery of such high-bandwidth video?

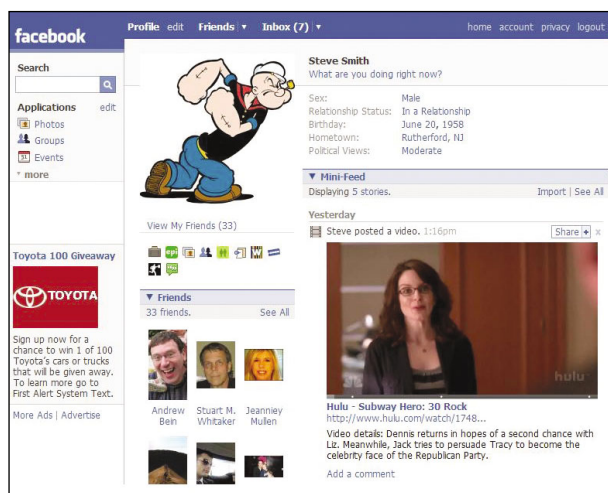
Feng: We use Akamai as our content delivery network. They use edge servers way out in the last mile from the end user to shorten the hop the end user has to make to start watching that video content. It improves latency and performance and makes the experience more instantaneous. It reduces the number of hits that come back to origin. Ruby on Rails is a great boon to productivity, but a lot of folks have questioned Rails' performance and scalability. We have been able to deal with a lot of those challenges by reducing the amount of traffic that flows back to origin by leveraging Akamai and their caching layers on the edge. Those hits stay off of our servers and stay off our origin destination load. Between beta and production, we scaled up the servers about six times.

CPU: Any plans for a mobile implementation?

Feng: I think mobile is very interesting, and there's a lot of potential here. But we have a very singular focus on a browser-based streaming experience. We want to make sure we nail the browser-based user experience before we try something else. It is hard enough to do one thing right, but it's more than twice as hard to do two things right. ▲



A simple Share button can send a TV episode from Hulu, including its advertising spots, to most of the major social networks.



"30 Rock," or scores of other programs, can now run directly off of your own Facebook page.

TV episodes. While not quite as easy as flicking a remote control, Hulu is encountering the kinds of search and navigation issues that all on-demand media will face in years to come.

Hulu Ubiquity

Hulu was conceived as a video content hub that also "hyper-distributed" video throughout the Web, letting it reside pretty much wherever members wanted it. With charter launch partners AOL, Yahoo!, MSN, MySpace, and Comcast, Hulu claims to reach 80 to 90% of the U.S. Web population. More exciting is the viral component that extends beyond the major portals and into that long tail of personal media. "The most interesting feature, the one we have gotten the most buzz about, is the ability to virally embed

a piece of video from Hulu onto your own blog or other Web site," says Feng. The process is made simple within the interface. Site builders and more accomplished bloggers can use the Embed option to copy code to the clipboard for pasting into HTML code. But everyone else has a Share button that sends the video to eight major media sharing sites. You can plant a player with the show directly on your social network or send links for it to Digg and Reddit. For instance, once we hit the share button, we had a fully playable version of the latest "30 Rock" episode ready for playback on our Facebook and MySpace pages in about three clicks. According to Feng, even a few weeks after formal launch, "We have been able to

see 50,000 unique videos proliferate to over 6,000 unique sites."

Ads We Can Live With

NBC and News Corp. went into the online video business because they believed big brand sponsors needed a safer place to advertise than the unpredictable content on YouTube or Break.com. Advertisers such as McDonalds and Proctor & Gamble are sensitive about where their brands show up online and next to which content. A fundamental part of the business model for Hulu was that by aggregating content from trusted major media sources, TV's top sponsors would feel more comfortable about placing video spots online and so would underwrite online video in the same way they fund most of TV and

radio. According to NBC's Zucker, this bet is paying off in sold-out ad inventory at premium sponsorship prices.

But will users tolerate the classic online video spot, the preroll? Hulu wants to rewrite that part of the video equation by keeping sponsor messaging short. Feng says that the Hulu policy is to show during a typical full-length TV episode only about a quarter of the advertising a viewer would encounter seeing the same show on TV. On Hulu, you get the same ad breaks as on TV but with shorter spots totaling only two minutes. Feng says the research shows shorter is more effective. "It allows for higher recall rates and a more seamless user experience," he says.

In the end, control is what Hulu is selling us—control over a TV experience that once forced us to "make appointments" with our technology. By pouring prime time television online and into formats that follow us around the Web and the Desktop, it's trying to reverse the polarity of mass media. But will advertisers, other TV producers, and the viewers all play along?

Don't touch that dial. ▲

by Steve Smith

Infinite Loop

A Heavenly Gravestone

Japanese tombstone manufacturer Ishinokoe has come up with the idea of adding barcodes to gravestones. Surviving relatives can scan the barcodes with their cell phones to see photos and information regarding the dearly departed. Visitors will be able to upload information, as well. This may be the best way to keep in touch with loved ones long gone since the days of the séance.

Source: *The Inquirer*

www.theinquirer.net/gb/inquirer/news/2008/04/03/barcodes-tombs-connect-dead

The Department Of Stuff

by Rob "CmdrTaco" Malda

email.txt

There is a long-running joke on Slashdot about how email is for old people. This meme was spawned years ago by stories about how the youth of today are more interested in "faster" types of communication, such as IM or even Twitter, and has only grown more powerful as social sites like Facebook become communication tools.

What I find interesting about all of this is that the first wave of direct Internet communication—email—usurped the corporate memo as the *de facto* method of communication. In the mid '90s, I worked tech support at a large corporation that was in the midst of the final transition to email from the dark ages of paper. I actually watched executives dictate memos to secretaries. I saw handwritten notes and copy machines whirring out millions of copies of text on reams of paper that was almost immediately discarded.

It was only the older employees, the ones whose position within the company had afforded them lackeys, who resisted learning a mail client or even how to type. I'm sure that people like that exist today, but they must be a rarity now. Unless maybe I am that person now.

Now, I started with email in the '80s when I was in middle school. It soon replaced the telephone as my primary mode of communication with my peers. By college, you wouldn't even consider calling a friend. For that matter, you only printed out that primitive "paper" for professors, who mostly were in that same demographic as the executives with secretaries who could take dictation.

But email is largely fading. I'm not exempt from this. At this moment, I am connected to no less than five chat services. From my internal corporate jabber network to old public networks used by friends to the now-ubiquitous SMS text messaging network built into my phone.

Clearly this is overkill. I look forward to a few more years down the line when all of these services merge into a single interface. Most of the better chat clients let you

merge multiple chat networks, but none include SMS and let you transparently move from laptop to cell phone and maintain your discussions. Or better yet, to unify email, and dare I suggest the countless Web message boards I read.

And the generation after me has gone several steps further. They use Facebook instead of email for many. They use Twitter instead of chats. And for them, text messaging is what email was

for me a decade ago. The first choice for communication, not the desperate last chance to get a hold of someone who you suspect is AFK. Who knows what things will look like as handheld computers with smallish screens become the norm.

Of course email has its place. Longer prose and conversations are impossible using SMS. Attaching files is still somewhat iffy, especially when you aren't aware of the target device. But these issues are fading. All I can hope is that someday, someone finally builds the mailbox that integrates all of my modes of communication into a single UI, and allows me to take them with me. Between Gmail and GTalk and the iPhone and iChat, there are a number of efforts out there.

It's a complicated problem because the nature of these forms of communication are fundamentally different; the length of the communication, the expectation of response time, chat systems, message boards, email, and all those silly Facebook wall pages each have different expectations. I should be able to tell from a single interface which method is appropriate for my needs without juggling 7 Web tabs, three applications, my cell phone, my land line, and of course dialing into voicemail.

It sure would be great if someone gets it right before I turn into the old executive who has a secretary with thumbs blurring taking my dictation into whatever comes next when text messaging is for old people too. ▲



Rob "CmdrTaco" Malda is the creator and director of the popular News for Nerds Web site Slashdot.org. He spends his time fiddling with electronic gizmos, wandering the 'Net, watching anime, and trying to think of clever lies to put in his bio so that he seems cooler than he actually is.

Contact me at malda@cpumag.com

Buffalo Beefs Up Travel Drive

Travel drives have been around for quite a while now, but Buffalo upped the ante with the \$329 500GB MiniStation TurboUSB portable hard drive. The bus-powered, shock-resistant, 5,400rpm drive features a wrap-around USB cable for convenience and is equipped with Buffalo's proprietary TurboUSB technology, which Buffalo claims makes the MiniStation 30% faster than other portable hard drives. The drive also includes the SecureLockWare application, which uses AES encryption for individual files or the entire drive, and Memeo's AutoBackup software. ▲



Buffalo's 500GB MiniStation TurboUSB portable hard drive puts half a terabyte of data in your pocket.

SanDisk Brings SD-Based Backups To An ExpressCard Slot Near You

SanDisk aims to make regular backups as automatic as possible with its FlashBack Adapter, which fits into your laptop's ExpressCard slot and is compatible with SD/SDHC cards of any capacity. Using the included software, the FlashBack Adapter will back up your data when files are changed, added, or deleted, without any manual action. An optional online backup service from BeInSync (www.beinsync.com), which is available for a \$59.95 per year or \$149.95 for a perpetual license, will keep your data protected if your laptop is lost or stolen. The FlashBack adapter will be available this quarter for \$29.99. ▲

Belkin Mini Surge Protector Puts You In Charge

Belkin's new miniature surge protector may deserve a permanent place in your travel bag; the diminutive accessory features three AC and two USB outlets to power and charge a variety of mobile electronic devices. A mini-USB cable is included for devices such as the Motorola Razr or RIM BlackBerry, or you can use your own device-specific USB cable to charge your digital music player, PDA, etc.

The wall plug rotates 360 degrees and has four locking positions, so you can use it with even the most awkward hotel room setup. The product carries both a lifetime warranty and a \$75,000 connected equipment warranty. The Mini Surge Protector with USB Charger is available for \$24.99. ▲

Blue Lounge Offers Sanctuary For Mobile Devices

These days, it isn't just your watch, pocket change, and keys that need a resting spot at the end of the day. Your mobile phone, PDA, and iPod need homes, too, but that also means that your counter may quickly be covered by assorted chargers and cables.

With that in mind, Blue Lounge's Sanctuary is designed to keep all of your daily necessities organized. It measures 1.85 x 9 x 9 inches (HxWxD). The Sanctuary has 12 built-in charging connectors, including micro-, mini-, and standard USB, plus proprietary connectors for Apple (iPod and iPhone), LG, Nokia, Palm, Samsung, and Sony Ericsson devices.

You can temporarily remove the inner tray to select the appropriate connectors for your devices and then reinsert the tray to create a clean, clutter-free spot to charge your devices overnight. Blue Lounge also offers other useful accessories, such as Cool Feet (\$12.95), a set of four feet that attach to your laptop via suction cups to aid in heat dissipation and tilt the machine slightly for more ergonomic typing, and Pop (\$9.95), which attaches to your iPod directly for earbud cable management and storage. The Blue Lounge Sanctuary is available now for \$129.95. ▲

The Blue Lounge Sanctuary organizes and charges all of your mobile devices, keeping them ready to go at a moment's notice.





HP's new 2133 Mini-Note is small enough to take anywhere yet powerful enough for almost any job.

Asus, HP Introduce Competing Mini Laptops

Competition is heating up in the miniature computer market, with HP and Asus offering new options to consumers. The HP 2133 Mini-Note computer has an all-aluminum casing with a scratch-resistant, 8.9-inch WXGA screen (1,280 x 768 resolution), a Via C7-M processor (up to 1.6GHz), Via Chrome 9 graphics, up to 160GB of storage (4GB of flash storage is also an option), and up to 2GB of RAM. Additional features include two USB ports, one SD card slot, one ExpressCard slot, a VGA-out port, Gigabit Ethernet, and 802.11a/b/g. Bluetooth connectivity and a VGA camera for video calls are available as options.

The keyboard is 92% of full size and is equipped with HP DuraKeys, which HP claims ensures that the printed letters won't rub off with heavy use. HP 3D DriveGuard is also included to protect against data loss or hard drive damage from dropping the laptop. The Mini-Note comes with two batteries, a flush-mount 3-cell and a high-capacity 6-cell, which also raises the back end of the Mini-Note for a more ergonomic user experience. The machine weighs 2.8 pounds and measures 10.04 x 6.5 x 1.05 inches (HxWxD).

Users can choose from models with Windows Vista Home or Business (includes a Windows XP downgrade option), SUSE Linux Enterprise Desktop 10, or FreeDOS.

Asus has cemented its position in the mini notebook segment with an update of its popular Eee PC. The new Eee PC 900 has an 8.9-inch screen (1,024 x 600 resolution), 1GB of RAM, and a 900MHz Intel Celeron M. All Eee PCs have a built-in 4GB flash memory module, but Linux Eee PCs have an additional 16GB flash storage. WinXP-based Eee PCs are stuck with an additional 8GB. The new FingerGlide touchpad is designed to make scrolling through documents and zooming in and out on photos easier. Other features include a 1.3MP Web cam, three USB ports, 10/100 Ethernet, and 802.11b/g. The new Eee PC 900 weighs 2.2 pounds and measures 8.86 x 6.7 x 1.33 inches. ▲

FCC Announces National SMS Alert System

Your mobile phone is essential for work and personal communication, and the federal government is aiming to make it indispensable for emergency notifications, as well. According to the plan created by the FCC to comply with the WARN (Warning, Alert, and Response Network) Act of 2006, wireless phone subscribers will be able to receive three different types of SMS alerts: presidential alerts related to national emergencies, imminent threat alerts (including weather and natural disasters), and child abduction/Amber alerts.

Carriers will be able to opt in or out of the emergency alert program. The FCC will also require carriers to include distinct vibration and audio alerts to ensure people with disabilities are also able to receive alerts. Once the FCC designates an agency to spearhead the program, participating carriers will have to comply with the rules of the program within 10 months. ▲

Zoombak Universal Locator Finds Your Stuff Anywhere

Zoombak has adapted its service for mobile users with the introduction of its Universal Locator. Small enough to be attached to a laptop or slipped into a briefcase, the device weighs only 2.5 ounces and measures 2.86 x 1.67 x 0.8 inches (HxWxD), but it can provide instant location alerts via phone or Web page (SMS text alerts are coming soon). Users can activate the Universal Locator manually or program it to activate when it leaves a predetermined safety zone, such as your home or office. The rechargeable battery provides approximately five days of standby power. The Universal Locator is \$199, and service plans start at \$9.99 per month; it will be available in stores during the second quarter. ▲

At Your Leisure

The entertainment world, at least where it pertains to technology, morphs, twists, turns, and fires so fast it's hard to keep up. But that's exactly why we love it. For the lowdown on the latest and most interesting releases in PC entertainment, consoles, DVDs, CDs, and just leisure and lifestyle stuff we (for the most part) love and recommend, read on.

Audio Video Corner

by Blaine A. Flamig



Free
Null
www.nin.com

Nine Inch Nails—"The Slip"

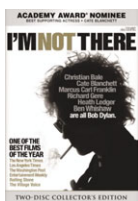
Even if you're not of member of The Cult of Trent Reznor, you have to admire Nine Inch Nails' headman for not only giving the band's latest release away to fans free, but for how he does it. On its Web site, NIN writes, "As a thank you to our fans for your continued support, we are giving away the new Nine Inch Nails album 100% free, exclusively via nin.com." Just sign up at dl.nin.com/theslip/signup, and NIN emails you back a code to download "The Slip" in high-quality MP3, FLAC, M4A lossless, or 24/96 WAVE files. Nice. Also nice are the songs that make up the release, which reflect the same brooding, chaotic energy you'd expect from a NIN release. Look for hard-copy CD and vinyl versions in July.



\$14.99
Reprise
www.mudcrutchmusic.com

Mudcrutch

Back in 1970, Tom Petty was just 17 when he, Mike Campbell, Tom Leadon, Benmont Tench, and Randall Marsh formed Mudcrutch in Petty's home turf of Gainesville, Fla. After making a go of it for roughly four years, Petty later found greater success on his own and with the Heartbreakers, of which Campbell and Tench are long-time staples. Remarkably, nearly 25 years after disbanding Mudcrutch, Petty sent feelers to Marsh and Leadon (brother of one-time Eagles' Bernie Leadon) and reformed the outfit. Even more remarkable is the group's quickly put-together self-titled release, which goes heavy on California-laden country, Americana-styled melodies, and extended jams. Petty, who plays bass here, also hands over the microphone to his fellow Mudcrutchers. The result is a surprisingly outstanding down-home gem.



\$29.99
The Weinstein Company
imnotthere-movie.com

I'm Not There

"Inspired by the music and many lives of Bob Dylan," "I'm Not There" is a fascinating, gritty, sometimes difficult exploration into the many façades of Bob Dylan. Those more ambivalent toward Dylan's career may find Todd Haynes' ("Far From Heaven," "Velvet Goldmine") film meandering and confusing. Those with a more intimate knowledge of Dylan, however, should find Haynes' unconventional approach brilliantly entertaining. Bolstering the film's art house-like magnificence considerably are the outstanding performances Haynes gets from Christian Bale, Cate Blanchett, Richard Gere, Ben Whishaw, Marcus Carl Franklin, and the late Heath Ledger, all taking on Dylan at various points in his life. Sprawling, hypnotic, and undeniably left-of-center, "I'm Not There" is adventurous filmmaking centered on arguably America's most adventurous musician ever.



\$19.98
Universal Studios
mst3k.com

Mystery Science Theater 3000: The Movie

Cult fans of "Mystery Science Theater 3000" already know the simplistic brilliance of this one-time syndicated TV series, which later enjoyed a long run on Comedy Central: MST3's running plot pretty much boils down to nothing more than a man and his "bots" being forced to watch horribly awful B-grade movies by an evil scientist trying to determine how much cinematic pain one can endure before going loony. Originally released in 1996, "Mystery Science Theater 3000: The Movie" finds Mike, Tom Servo, and Crow T. Robot forced to withstand the 1950s-era and sinisterly foul "This Island Earth." As any MST3 fanboy will tell you, however, the worse the movie Mike and crew must witness, the better the sarcastic banter that follows.

DVD Byte

6/3

The Eye
Meet the Spartans
Semi-Pro
Vince Vaughn's Wild West Comedy Show

6/10

The Bucket List
Jumper

6/17

Be Kind, Rewind
Fool's Gold

Welcome Home
Roscoe Jenkins

6/24

10,000 B.C.
In Bruges
The Spiderwick Chronicles



See the full reviews from A/V Corner at www.cpumag.com/cpujun08/AYL

Grand Theft Auto IV



Once More, With Feeling—by Chris Trumble

\$59.99 (360, PS3) • ESRB: (M)ature • Rockstar Games • www.rockstargames.com/IV

It's hard these days to separate any Grand Theft Auto game from the hype and controversy that inevitably precede and follow its launch, and predictably, Grand Theft Auto IV is no exception. The politicians and general media will likely hold up the game's gaudy sales numbers (3.6 million copies sold on the first day alone) as proof that gamers are bloodthirsty sociopaths looking for opportunities to practice criminal depravity before they take it to the streets.

As you know, however, there are plenty of hyper-violent videogames out there that offer nothing more and that shipped to the sound of chirping crickets. Such games rarely even recoup their production costs, and you won't hear Congress calling them out at election time.

The true appeal of GTAIV lies in the fact that Rockstar has managed better than ever before to deliver a blend of several disparate game types without shortchanging any single portion of the experience. Many players won't make this realization consciously, and that's the beauty of it: The game never gives you a reason to look behind the curtain. Thoughtful players who spend some time in the game will realize upon reflection that the game lets them move seamlessly from driving to on-foot combat to a number of minigames (bowling, poker, and so on) to managing relationships and more. In other words, the game is a complete sandbox

experience that lets you move from one aspect of the story and your character's life to another much as you would in a movie.

Also, it doesn't hurt that GTAIV is stunningly beautiful. Rockstar has made incremental improvements to every GTA game since it left the top-down, 2D gameplay of the first games behind, but GTAIII, Vice City, and San Andreas were all very similar with regard to the level of graphic realism they provided. GTAIV, on the other hand, is a whole new ballgame, thanks to the greater graphical muscle of the Xbox 360 and PlayStation 3. The new, more powerful generation of consoles have also allowed GTAIV to move beyond just offering Rockstar's trademark, excellent in-game radio stations to offering some TV content, as well as a pretend Internet.

You play the game as Niko Bellic, a Serbian immigrant who has been lured to America by his cousin Roman with promises of wealth and success, only to find that Roman lives in squalor and owes considerable sums of money to the wrong kind of people. As in GTAIII, however, there is more to the story than meets the eye at first, and ultimately Niko isn't just in the United States for a shot at a house in the suburbs with a white picket fence.

Although the basic GTA framework remains intact in GTAIV, many of the details have changed. Some of these changes are tiny artistic things, such as the way Niko flies through the windshield now in a head-on collision. Others, such as the addition of quality multiplayer game modes and the interesting moral dilemmas the game serves up on selected occasions—one of which ultimately determines the ending you see—are much bigger.

The upshot of all this is that Grand Theft Auto IV is the biggest, baddest, and best game of its type, although it would suffice to say that it's the best GTA game ever made, as most competing products to date have been pretty fairly suspect. And, although it's early, it seems likely that this game will also have a shot at being the best game of 2008. ▲

GRAN TURISMO 5 PrologueTM

THE REAL DRIVING SIMULATOR

Masterpiece Preview Theatre—by Dr. Malaprop

\$39.99 (PS3) • ESRB: (E)veryone • Sony Computer Entertainment • us.playstation.com/gran Turismo

With approximately a year before the final release of Gran Turismo 5 hits shelves, Sony has opted to put out Gran Turismo 5 Prologue as a preview. This is GT's first foray on the PlayStation 3, and it looks spectacular. The cars are the stars, and developer Polyphony Digital has rendered them with obvious love and attention. Each car has four views: Bumper, Hood, Behind Car, and In-Car. The In-Car option features reproductions of each vehicle with working gauges and is as close as many of us will ever get to experiencing these speeds. Unfortunately, there's still no damage modeling on the cars, so smashing into walls at 180 mph seems to lack... impact.

The game features more than 70 cars and six tracks (along with six deviations of those tracks) but quickly feels limited. Tracks have their own unique strategies, and in-game races take that into account to create challenging racing experiences. Post-race replays often seem photorealistic, and we watched many hours in lustful admiration. The AI racers feel sterile and computer-like—unlike the AI racers we enjoyed so much in Forza Motorsport on the 360.

We recognize that charging \$40 for GT5 Prologue costs \$20 less than the average PS3 game, which helps justify its cost. However, there's no disguising that this game is only a warm-up lap for the actual race. Including a \$10 coupon in the retail package toward purchase of the final game would have gone a long way toward building goodwill. GT5 Prologue looks gorgeous and plays well but feels stunted—a great sampler that hints at a masterpiece. Rent this game and play Forza Motorsport on the 360 while you wait. Naturally, we'll be first in line for GT5 when it's ready for release. Sony, consider our appetites whetted with the rental. ▲



Three settings can be saved per car; you can save these in location A, B, or C.



MARIOKART^{Wii}

Safely Enhanced—by Dr. Malaprop

\$49.99 (Wii) • ESRB: (E)veryone • Nintendo • www.mariokart.com

Fifteen years of Mario Kart have not slowed it down. Fans of the series will have a great experience, and new players should fare even better. The game doesn't get as creative as Mario Kart: Double Dash because the developers played it relatively safe with this iteration. The most obvious new features of the game arrive in the form of motorbikes and stunts. The former fits in surprisingly well within the gameplay, and the stunts let players get boosts for their vehicles in Mario Kart's traditional mad slapstick dash to take pole position.

As with the incredible Nintendo DS version, the Grand Prix mode is the heart of the game. Here you race 11 other computer competitors over 32 courses (16 new plus 16 classic) and eight cup events that iterate from 50cc to 100cc to 150cc engines. The 50cc features only karts, 100cc features only motorcycles, and 150cc brings it all into play. The first two sets of races are a lot of fun, but the 150cc races feel unbalanced; AI characters attack with annoying frequency and precision. The Wii's tepid online gaming system is implemented superbly in the game thanks to the Mario Kart Channel, which can be downloaded to the main Wii screen to match up for races without even being in the game.



Mario Kart Wii looks better than it ever has, featuring 480p wide-screen support (not HD), and comes bundled with a plastic wheel. The Wiimote slots into the wheel and lets players steer. Does it work? Sure, give it some time and you'll eventually acclimate to the control. Does it appeal to the uber-casual gamer? That's very likely. However, Nintendo provides three other control schemes. Our preference was using the Wiimote in conjunction with the nunchuck, which felt more natural to us than the wheel. Mario Kart Wii can be enjoyed by up to four players or online. We expect the game to entertain for many months to come. ▲

CRISIS CORE FINAL FANTASY VII

The Gang Is Back (Even Aerith)—by Chris Trumble

\$39.99 (PSP) • ESRB: (T)een • Square Enix • www.crisiscore.com

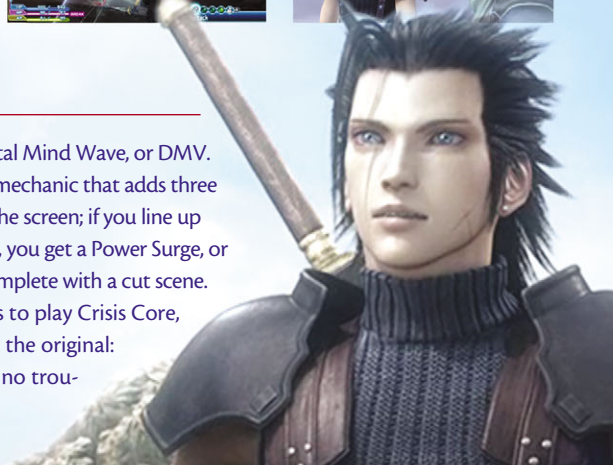
The PSP has really come a long way since its launch; we're finally seeing really good first-run titles made just for the system. Crisis Core: Final Fantasy VII is just such an animal.

Crisis Core is a prequel to the PlayStation blockbuster Final Fantasy VII, so many of that game's core characters are back, although Crisis Core has a new main character, Zack Fair. Zack is a member of SOLDIER, an elite unit of The Shinra Electric Power Company's military force.

In addition to introducing new characters and story elements to the Final Fantasy VII mythos, Crisis Core steps up with

a new combat dynamic called Digital Mind Wave, or DMV. DMV is sort of like a slot machine mechanic that adds three spinning reels to the upper left of the screen; if you line up three like picture/number combos, you get a Power Surge, or limit break-esque special attack complete with a cut scene.

FFVII fans owe it to themselves to play Crisis Core, but don't worry if you didn't play the original: The game is outstanding and has no trouble standing on its own merit. ▲



Art In Play—by Dr. Malaprop

\$49.99 (Wii) • ESRB: (T)een • Capcom • www.capcom.com/okami

The original release of Okami debuted nearly two years ago on the PS2. It features strong narrative, unique style, and inspired cell-shaded visuals (the word "artistry" comes to mind). You're in for an engaging treat on the Wii if you've never played the original RPG adventure, which was inspired by the classic Zelda series. This is the serious, touching side to the wacky experiences brought about by Super Mario Galaxy or Mario Kart Wii.

Japanese mythology sets the backbone to Okami. You play as Amaterasu Okami (Japanese

Sun Goddess in the form of a white wolf) and her sprite sidekick, Issun. Both are artists who can command what's known as the Celestial Brush, which lets you interact with the environment and character using brush strokes. In the most simplistic terms, Amaterasu represents the good and is tasked with saving the world from an unleashed evil.

You'll wield the Wiimote to make disembodied brush strokes as a core part of the gameplay. The horizontal slice stroke was hard to implement consistently but can be forgotten fairly early in the game to make it a nonissue. Words do not

do justice to Okami's gameplay and artistry. This is the first Wii game to touch our emotions, and we see it in dreams. ▲



UNIVERSE AT WAR EARTH ASSAULT

**Another RTS Takes On The Console
—by Dr. Malaprop**

\$59.99 (360); \$49.95 (PC) • ESRB: (T)een

Sega • www.sega.com/gamesite/universeatwar

We looked at the PC version in the December 2007 issue, but console RTS games are still a rarity, so we wanted a closer look at this port. Earth is the site of a massive assault by an alien race that culminates in battle between three races (the Hierarchy, Novus, and Masari). The races' unique attributes provide ample variety as you play through the likeable campaign.

Commit to Universe At War: Earth Assault and you'll quickly come to terms with its excellent control scheme, which is an improvement on anything we've seen on

a console before. The control is not a barrier for quick access to units and movement; we especially like the easy access to the game map via the right trigger.

The game is flawed in its poor path finding (leading to unit micro-management) and abysmal frame rates that took us completely off-guard. It's too bad. UAW:EA is likeable and for RTS fans may still be an entertaining offering, but it's not the breakthrough console RTS that will convert masses to the genre. ▲



ASSASSIN'S CREED

LIMITED EDITION



Good Things Come To Those Who Wait—by Dr. Malaprop

\$54.99 (PC) • ESRB: (M)ature • Ubisoft • assassinscreed.us.ubi.com

We reviewed Assassin's Creed for Xbox 360 in the April 2008 issue, but PC gamers had to wait several months for Ubisoft to put out the PC version. Ubisoft has largely succeeded in this port and has enhanced the game, which features four new side quests unavailable on the consoles. Visuals are improved with DX10 graphics at resolutions up to 2,560 x 1,600 with support for the latest bells and whistles: dynamic lighting, depth of field, and particle lighting, among others. AC requires high-end system specs

to shine, and it's not pretty on low- to midlevel PC hardware. Already excellent atmosphere gets a boost thanks to the improved visuals. The keyboard-mouse controls are less intuitive than game controllers on a console, but they work well, and both controller types are supported.

AC features the same problems with mission structure as its console counterparts. However, that doesn't dissuade us from wanting to play in this world and considering it a must-have. ▲



Sony Dualshock3 Wireless Controller

What's Old Becomes New(s) —by Dr. Malaprop

In an early 2007 interview with Gamedaily.com, then-Sony Computer Entertainment Worldwide Studios President Phil Harrison noted, "Now, rumble I think was the last-generation feature; it's not the next-generation feature. I think motion sensitivity is. And we don't see the need to do that."

So here it is, a PS3 controller with motion-sensing control and rumble. Hallelujah. The Dualshock3 is the controller Sony should have released from the start. The product's slight weight increase gives it heft in a good way. The Dualshock3 feels more like a game controller and less like a cheap see-through toy. The rumble technology is essentially identical to that in the PS2 and is supported in a number of games. Go to blog.us.playstation.com/2008/04/02/feel-the-shock-next-week to see a list of rumble-friendly titles

supported at the Dualshock3's launch. Expect rumble support in nearly all future titles.

Happily, Dualshock3 is now standard on new PS3 packages. Sixaxis fans can disable rumble from the PS button menu. Now's the time to stock up if you're in love with the feather-weight nonrumbling Sixaxis. The \$15 boost over the Xbox 360 Wireless Controller (sans motion-sensing) feels overpriced for PS3 buyers that received Sixaxis controllers. Then again, it's the price we pay for early adoption. ▲



\$54.99

Sony Computer Entertainment

www.us.playstation.com/PS3/About/Controller

CPU Rating: ●●●●

Razer Mako 2.1 Advanced Desktop Audio

Minimalist Look With Maximum Sound —by Dr. Malaprop

Not everyone wants the clutter of a 5.1 PC sound system. And Razer would like to fill this space with the Mako 2.1, which attempts to create a wider sweet spot for the listener.

This kit was developed in conjunction with THX and takes a different approach to getting audio from the sound card to your ear canal. Each minimalist pod-looking satellite speaker uses THX Ground Plane; the satellites fire sound downward at your desk surface, which bounces up to your ears. What sounds hokey on paper sounds superb in practice. The clear, powerful sound that this package outputs for games (tested with Assassin's Creed, Crysis, and Call of Duty 4), music, and

movies with that great sweet spot has made it one of our favorite 2.1 speakers at pretty much any volume.

To get the benefits of the great audio positioning and wide sound space, you'll need to ensure that you have at least 3 inches of clear desk space around each satellite, but 6 inches improves the sound noticeably. The system uses flat cables with a standard Ethernet connector to carry power to the speakers from the sub



\$399.99 • Razer

www.razerzone.com/p-90-razer-mako-21-advanced-desktop-audio.aspx

CPU Rating: ●●●●●

and features a touch-sensitive Command Center. The Command Center looks great but can be finicky when trying to fine-tune the volume. At \$400, we expect a 2.1 system to sound fantastic, which it does. The unit provides motivation to unclutter your desk, and it looks cool to boot. ▲

The Cutting Edge

by Barry Brenesal

The Rise & Rise Of The Trackball

The trackball? Cutting edge? After all we've been through together, how can you doubt me? Consider: The trackball does everything the mouse can, with less long-term damage to the human body. It is easier to work (and certainly to play) with in most situations than a graphics tablet. The problem for the trackball hasn't been a lack of technological superiority, but the lack of marketing power behind its promotion.

But we get ahead of ourselves. The origins of the trackball take us back to the late 1940s, when the Royal Canadian Navy began work on an electronic tracking and communications system that would eventually be known as DATAR (Digital Automated Tracking and Resolving). By 1952, a pair of young Canadian radar engineers, Tom Cranston and Fred Longstaff, had produced a moveable input peripheral that would allow for pinpoint, human-controlled tracking on a radar screen. It was the first trackball. Analog circuitry was used, but the team got creative when it came to producing a wheel that operated concurrently along two dimensions. They employed a standard 4-inch Canadian 5-pin bowling ball.

Lack of cash and political changes eventually led the Canadian government to cease funding development of DATAR. No other friendly governments had any interest, as they were pursuing their own radar systems, but enough demonstrations had been given to impress many people, if not with DATAR's possibilities, then arguably with the trackball. Ironically, the DATAR design team had overlooked the importance of the latter, and not bothered acquiring any patents.

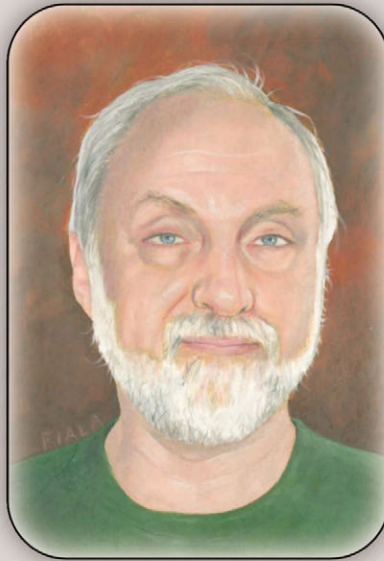
Not surprisingly, as a result, the trackball spread. Over the next 20 years, it repeatedly showed up in various top-of-the-line industrial process control systems. The original Atari Corporation eventually took note, too, and introduced imbedded trackballs in its 1979 release of the coin-operated arcade game, *Football*. They followed up with other, similar titles, including *Centipede* (1980), *Missile Command* (1980), and *Crystal Castles* (1983). Each was ported along with trackball controllers to various Atari home systems, though only with control along the x/y axes.

But a more famous demo by Douglas Engelbart, inventor of the mouse, greatly influenced Xerox and its Palo Alto Research Center in the 1970s. The mouse migrated in turn to Xerox's own 1979 GUI-based demo to Steve Jobs. Apple subsequently bundled a mouse with the Lisa in 1983, and while it failed due to poor market research and overpricing, the mouse returned with the Mac three years later. Various GUIs that proliferated on PCs during the 1980s followed suit. Micro-

soft, for example, chose to offer a software-plus-mouse bundle in 1983 with the first release of its word processor, *Word*.

Piggybacking peripherals on top of a single, popular purchased product greatly increases the visibility for those peripherals, and the mouse benefited accordingly. But this ultimately led in the late 1980s to a mouse glut on the market. Logitech, benefiting from research that showed as much as 10% of surveyed PC users would try out a trackball, produced the first *TrackMan* release in 1989. The trackball gained further traction (if you'll excuse the expression) with the advent of portable computing, since trackballs require less operating space than mice. Logitech, taking note of this, issued its *TrackMan Portable* in 1991, and Microsoft, taking note of Logitech, issued its *BallPoint* trackball the same year.

There were initially some compatibility issues with mouse ports and trackballs, but these were soon resolved. Increasing numbers of high-tech trackballs appeared in subsequent years with wireless connections, no mechanical parts, scroll wheels or rings, programmable function buttons, and ergonomic refinements such as index finger rather than thumb control. There are mini-trackballs, trackball-imbedded keyboards and keypads, and trackballs with imbedded laser pointers. If I were a futurist, I might predict such elegant developments as the fuel cell trackball, the Kucinich telekinetically-controlled trackball, and the Cheney coal-powered trackball embedded in a shotgun. But I'm not, so I'll stop at predicting that the trackball will continue to have its enthusiastic adherents for years to come. ▲



Barry Brenesal has written more than 1,000 published articles and reviews on electronic technology since 1987. His first personal computer was a Radio Shack TRS-80 model 100.

It was last seen functioning as a boat anchor.

Wax nostalgic with Barry at
barry@cpumag.com

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Software

Tips & Projects

Summer Hot-Rodding

Power users know that every microsecond counts (well, at least *we* think it does). But why throw money and time into hot-rodding your PC if the software you use every day is slowing you down? This month, we take a break from projects to put a little accelerant in your tank for smoother summer driving. How do you speed up some of those oft-used programs? By clearing out the choke points. We focus on Firefox and Outlook, but we also toss in a handy Vista shortcut we have been using a lot lately. All of this month's speed tips involve clients that interact with the Internet.

Firefox Favorites

Everyone seems to have a Firefox speed tip. If you have changed to a new computer or OS, you may have forgotten to deploy the basic acceleration tweaks for most Firefox instances. There are a lot of arguments out there about what settings are appropriate for broadband

and/or faster/slower computers. These are the most common changes that seem to work for most systems.

First, in an open Firefox window, type **about:config** in the address bar to access the Configuration screen. Find and right-click the entry **network.http.pipelining** and use the Toggle command to change it from False to True. Now, find the **network.http.proxy.pipelining** entry and toggle that one to True.

Now, right-click anywhere in the browser window and select New/Integer. Rename it **nglayout.initialpaint.delay** and set that value to 0. Remember that the about:config screen does have its own Filter box on top. Rather than hunt and scroll for the right entry, just start typing its first letters in the box to bring up the right lines of controls.

For many of us, just loading Firefox produces the longest wait times. Many people swear by the open-source and free Firefox Preloader, available at sourceforge.net/projects/ffpreloader. We benefited some from

Filter:	Status	Type	Value
network.ftp.idleConnectionTimeout	default	integer	300
network.hosts.nntp_server	default	string	news.mozilla.org
network.hosts.pop_server	default	string	mail
network.hosts.smtp_server	default	string	mail
network.http.accept-encoding	default	string	gzip,deflate
network.http.accept.default	default	string	text/xml,application/xml,application/xhtml+xml,text/html;...
network.http.default-socket-type	default	string	
network.http.keep-alive	default	boolean	true
network.http.keep-alive.timeout	user set	integer	30
network.http.max-connections	user set	integer	48
network.http.max-connections-per-server	user set	integer	16
network.http.max-persistent-connections-per-proxy	user set	integer	16
network.http.max-persistent-connections-per-server	user set	integer	8
network.http.pipelining	user set	boolean	true
network.http.pipelining.firstrequest	user set	boolean	true
network.http.pipelining.maxrequests	user set	integer	30
network.http.proxy.keep-alive	default	boolean	true
network.http.proxy.pipelining	default	boolean	false

The about:config screen in Firefox is your doorway to hundreds of tweaks and possible speed boosts.

Windows Tip Of The Month

Windows Vista power users and administrators may need to understand the Power Plan settings under which a given machine operates (i.e. its available sleep states and hibernate modes). You can check out this feature by bringing up a command line (type **command** in the Run box). The Powercfg program gives you information related to the Power Plan and parameters for controlling it. For instance, typing **powercfg -a** lists the available sleep states on the PC. Other parameters can toggle Hibernate mode on or off or turn off sleep states. For a complete list of available commands, type **powercfg /?** at the command line.

Registry Tweak Of The Month

What does Windows load at startup? There are a couple of ways to find out. Within the Registry, however, all you need to do is go to the HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run to see some of what the OS loads at start. You can also go down the Key tree to HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnce. Here are the programs that Windows or third parties have designated to run the next time Windows reboots and never again.

the program, but not as much as we'd hoped, and we still hope that the final Firefox 3 release (coming soon) will shorten load times.

Don't forget to close those unused tabs in the browser window. Firefox is a terrible memory hog, and multiple open tabs will slow you down.

A Clear Outlook

Few programs get cluttered and sluggish faster than Outlook. While some users have upgraded to Office/Outlook 2007, many continue to rely on Outlook 2003, so our tips are geared toward that version.

You may be able to speed up some operations in Outlook by disabling unnecessary add-ins. In the Tools menu, open Options and then the Other tab. In the General section, click the Advanced Options button. In the next window, look for the COM Add-ins button. Here

you will find plug-ins installed by third-party programs that link to Outlook, such as iTunes (for contact syncing) or Google Calendar (for appointment syncing). Uncheck or remove the add-ins you no longer need. They may be slowing down Outlook's startup process.

Try disabling the Instant Messaging integration. In Outlook 2003, go to the Tools menu and choose Options. In the Other tab, look for the Person Names section and uncheck the Enable The Person Names Smart Tag. Many users report that disabling IM integration in Outlook accelerates switching between messages.

Quicker Outlook Entry

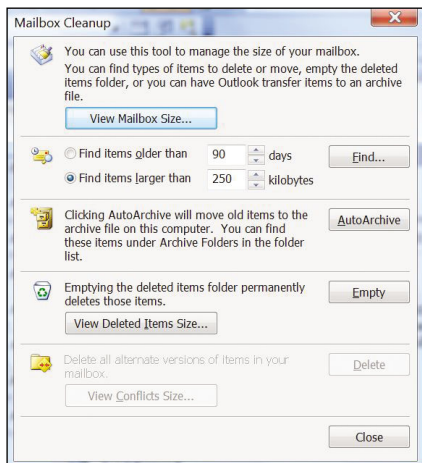
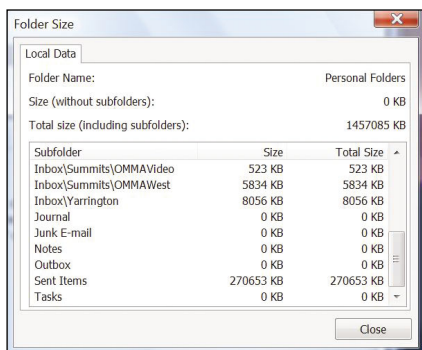
Why bother loading and reloading Outlook every time you need to compose a message or make an appointment? There are command line parameters for Outlook.exe that you can turn into handy Desktop shortcuts.

First, find your Outlook.exe program file in the Windows directory structure. We found ours in the Program Files/Microsoft Office/Office11 folder. Right-click the file, click Create Shortcut, and then drag the icon to the Desktop. Right-click the new icon and bring up its Properties file. In the General tab, rename the shortcut to New Message. In the Shortcut tab, go to the Target box, add a space to the end of the current item followed by /c ipm.note, and click OK. This shortcut should open a new message without opening Outlook. The message won't be sent until the next time you do have Outlook open, however.

For a new Calendar appointment, follow the same procedure above but name the shortcut something appropriate such as Appointment. The parameter for this item is /c ipm.appointment.

A Cleaner Outlook

The best way to speed up Outlook is to clean out old and oversized emails. In both Outlook 2003 and 2007, one easy way to locate the most obvious waste in an Inbox is to right-click the Arranged By label atop the Inbox and change the sort order to From. If you start typing a letter or phrase, Outlook automatically jumps to that keyword in the sorted list. This way you can



Outlook has its own powerful cleanup tools that can accelerate the email client substantially by deleting old mail and those monstrous attachments.

type mail, for instance, and gather together all of the messages labeled Mail Delivery System or MAILER-DAEMON, which usually contain the many useless bounce-back messages you may accumulate.

Another way to clean your Inbox efficiently is to use Outlook's often-overlooked internal tools. In the Tools menu, click Mail Cleanup. Here you will find the familiar AutoArchive option, but there are other options to try. First, get an overview of exactly how and where Outlook is cluttered by clicking View Mailbox Size. This breaks down every folder/subfolder by size to show where the bloat exists. For instance, your Sent box often can be larger than the Inbox because users rarely think to remove trash from here.

Far and away the best cleanup tool in Outlook is the Find command. If you use the radio button to designate Find Items Larger Than and designate a size (default: 256KB), you can easily filter items across

all folders that have attachments or are oversized messages. Use the Find button to do the search and Outlook gives you a host of additional filtering options. In the Advanced Find window, you can sort messages for easier deletion. You also can use the More Choices tab to filter the results even further (attachments only, unread, etc.). We find this approach to folder cleanup much more efficient and manageable than sorting through all of the massive Outlook folders in the main window. Don't forget to empty the Deleted folder when you're done with your cleanup.

A Vista Extra

Did you know that Windows Vista has an easy way to perform FTP functions? There are two ways to interact with an FTP site via the Computer command in the Vista Start menu. Open the Computer item from the menu, then click in the address bar and use the BACKSPACE key to clear it of the current address. Type in ftp://ftp.xxxxx for the correct FTP location and press ENTER. The Vista interface will navigate to the site and prompt you for a username and password, which Vista also will remember for future logins. The FTP site looks just like another Explorer file folder, and you can drag and drop files in and out of the folders to upload and download. ▲

by Steve Smith

Infinite Loop The Free Press

We, of course, are all in favor of freedom of the press, but it may not be long before we'll benefit from more free newspapers, as well. A report conducted by Zogby International shows that more than half of editors surveyed believe newspapers will have to become free to compete with the Internet. Also, about two-thirds of the editors felt that opinion and commentary features will become more prevalent in newspapers in the future.



Source: Zogby International www.zogby.com



Warm Up To Penguins

Shell Games

“Hi, this is Andy Rooney. Have you ever wondered just what happens when you type a command into a Linux shell? I know I sure have.”

OK, so we’re unlikely to see this as an essay topic on “60 Minutes” anytime soon, but understanding how a command you enter turns into a running program is a topic worth understanding. There are basically three types of commands (or programs) that you can invoke from the command line: built-ins, binaries, and scripts.

Built-ins are just that: commands that are built into the shell itself. For example, the “set” command is an intrinsic part of shells such as bash, csh, and sh. There’s no separate program that runs when you set a shell variable. You’re just using a different piece of the same program that’s already giving you your shell prompt.

Binaries and scripts exist in files separate from the shell itself. When you type the command `echo test`, for example, you’re actually running a program called `echo`. The shell figures out where to find the command by looking at a shell variable called `PATH`. For example, here’s a standard path under bash:

```
james@james-ubuntu-test:~$ echo $PATH
```

```
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games
```

This says that if we type a command, the first place to look for the file that matches the name of the command in the `/usr/local/sbin` directory, then `/usr/local/bin`, then `/usr/sbin`, and so on. If the shell gets to the end of the list and hasn’t found a directory that contains a file with that name, it will return an error saying it can’t find that command.

Binaries are programs that have been compiled from a programming language, such as C or C++, into the native instruction set of your computer’s processor. Scripts, on the other hand, are human-readable code that a program interprets when you invoke them. (At least you can hope that they’re human-readable; we’ve seen some pretty unintelligible scripts.) In Linux, you’ll commonly see scripts written in Perl, Python, Ruby, and the various shells (sh, csh, bash.)

One way to tell if a command is a script or a binary is to use the “more” command on it. For example, if we try doing a more on `/bin/echo`, we get:

```
james@vm2:~$ which echo
/bin/echo
james@vm2:~$ more /bin/echo
```

```
***** /bin/echo: Not a text file *****
```

This tells us that `/bin/echo` is a binary. If you want to make sure, you can use the “file” command, which gives you lots of useful information about a file.

For example, when we used `file` on the same command:

```
james@vm2:~$ file /bin/echo
/bin/echo: ELF 32-bit LSB executable, Intel 80386, version 1 (SYSV), for GNU/Linux 2.6.8, dynamically linked (uses shared libs), stripped
```

For the curious, this tells us the following: “echo” is stored using ELF (Executable and Linkable Format) for binaries; it is compiled for x86 processors; it requires the use of libraries in `/usr/lib` to run; and it has had all debugging information stripped out of it.

For comparison, let’s look at the “file” output for a pair of scripts.

```
james@vm2:~$ file /usr/bin/gdialog
/usr/bin/gdialog: perl script text executable
james@vm2:~$ file /usr/bin/ldd
/usr/bin/ldd: Bourne-Again shell script text executable
```

Looking at this, we can see that `gdialog` is a Perl script, while `ldd` is written using bash. (And yes, bash stands for Bourne Again Shell, a pun on the fact that it’s based on `/bin/sh`, the Bourne Shell.)

How does Linux know whether a command is a script or binary? And if it’s a script, how does Linux know what type of script? It knows by looking at the beginning of the file. For example, if the file is an ELF binary, the first characters in the file (in hexadecimal) will be 7F 45 4C 46. All scripts can be recognized by the fact that “#!” are the first two characters in the file name. In the case of scripts, the path to the program that can interpret the script must immediately follow the “#!.” For example, a Perl script would start “#!/usr/bin/perl.” A bash script, on the other hand, would begin with “#!/bin/bash.”

Roll Your Own Script

With this information under our belt, we’re ready to try our hand at writing a script. All of the shell scripting languages (sh, csh, and bash) are a little arcane to use, but using Perl to write scripts may be easier. Perl’s very similar to C or Java. But for this example, we’ll stick to something simple, so bash will do fine.

Let's start by writing a command that honors a great programming tradition, one that prints out "Hello, World!" The very first examples of this program can be found in the Brian Kernighan's book "The C Programming Language," which has been a tradition to use as a first programming example for a language ever since. So, here's our "Hello, World!" program, written in bash.

```
#!/bin/bash
echo "Hello, World!"
```

There's not much to look at, is there? The first line identifies the script as a bash script and tells Linux where to find the program that can interpret the commands. The second line is a normal command you could type into a bash command line prompt. Assuming that we saved these lines into a file called "helloworld," we could then try to run it. After typing **helloworld** at the prompt, we get the following output:

```
bash: helloworld: command not found
```

Oops, that didn't work so well. There are two reasons we weren't successful: the path and the permissions on the file. Remember when we looked at the PATH variable? There was a list of directories that the shell would search when you typed in a command name. What was missing from that list was the "current" directory, which is accessed in Linux using the "." character. So "./helloworld" would mean "the file helloworld in the current directory." You could add "." to the end of the list of directories in the PATH variable, but there are security reasons not to do that. Instead, we can just rerun the command specifying the directory.

```
james@vm2:~$ ./helloworld
```

```
bash: ./helloworld: Permission denied
```

Well, that's different but still not what we want. The other thing that a file has to have to be considered a run-able script is to have the "execute bit" turned on. Every file in Linux has three types of permission: read, write, and execute. Furthermore, these permissions can be different for the owner of the file, people in the same group as the file, and the world in general. For the purposes of this example, all you

```
james@vm2:~$ ./helloworld
bash: ./helloworld: Permission denied
james@vm2:~$ chmod +x helloworld
james@vm2:~$ ./helloworld
Hello, World!
```

In file listings, executable files will show up in green.

need to know is that helloworld doesn't have execute rights set for anyone, something you can see by using the "ls" command with the "-l" (long) argument.

```
james@vm2:~$ ls -l helloworld
-rw-r--r-- 1 james james 33 2008-04-20 21:27 helloworld
```

The important part of the output is the first part, which tells us that we have read and write permission as owner and that group and "world" have read permission only. We can change that using the **chmod** (command):

```
james@vm2:~$ chmod +x helloworld
james@vm2:~$ ls -l helloworld
-rwxr-xr-x 1 james james 33 2008-04-20 21:27 helloworld
james@vm2:~$ ./helloworld
Hello, World!
```

To finish off our look at scripts, let's write a script that actually does something. The file **/etc/passwd** has an entry for every user that the system knows about. If we want to get the entry for a given user, we can do it by typing the following:

```
james@vm2:~$ grep james /etc/passwd
james:x:1000:1000:James
Turner,,:/home/james:/bin/
bash
```

The **grep** command returns any lines in a file that match the specified string. Let's make a command, **finduser**, that will do it for any user we pick. Here's the script:

```
#!/bin/bash
grep $1 /etc/passwd
```

As you can see, "\$1" is the only new thing we added. Any time you use something that starts with a \$ in a shell, you're referring to a variable. For example, "\$PATH" at the beginning of the article is the way to get the value of the PATH variable. In any script, \$1 is the first argument used on the command line that invokes the script. (The \$0 variable, by the way, is the name of the script itself.) So, once we add the execute bit to the file, we can take it for a test drive.

```
james@vm2:~$ chmod +x finduser
james@vm2:~$ ./finduser root
root:x:0:0:root:/root:/bin/bash
```

And there we go, the \$1 variable is replaced by the argument "root," and the command outputs the results of the **grep** command.

We've spent the last few months digging around the guts of Linux from the command line. Next month, we'll get back to looking at some cool Linux applications, starting with a peek at audio editing with Audacity. ▲

by James Turner

Infinite Loop I Am Iron Man . . . Sort Of

Looking to relieve its overburdened troops, Canada's Defence Department solicited bids for military contractors to build "exoskeletons and other mobility devices" to "reduce the load burden for the soldier of tomorrow." The article would have you believe such a creation would be an Iron Man-type suit, which might be an accurate comparison except for the fact that it doesn't fly, has no armaments, and is completely free of an 18-year Glenlivet aroma.

Source: ca.news.yahoo.com/capress/080505/koddities/iron_man_canuck

Shavings From The Rumour Mill

by Mike Magee

PC Goes Through MIDlife Crisis

I interviewed Intel's Sean Maloney a week or two back. He is the firm's general manager of its sales and marketing division, and despite his Irish-sounding name, he's British.

Like a lot of Intel executives, he's been at the firm for a long time (since 1982), and he knows the semiconductor business up, down, and sideways.

What particularly interested me was what he had to say about MIDs (mobile Internet devices) based on the Atom microprocessor. Intel has really pushed this concept for all its worth this year, and we will see devices from a number of vendors. But, said Maloney, he doesn't see these devices really taking off for a couple of years or so, and the vast majority of the business Intel does is still CPUs for notebooks, desktops, and servers.

While the North American market and the Western European market are to some extent saturated, the next billion CPUs will be sold in Asia, South America, Russia, and Eastern Europe, he thinks.

Of course, there have been MIDs around for quite a while; Via jumped Intel by producing a reference design last year and has now had design wins from a number of big-name vendors, such as HP. But the word from Via is that it agrees the market probably won't really take off for another couple of years. Why is this? One reason is that Internet coverage, whether it's through Wi-Fi, 3G, or ordinary cell, still remains a little patchy.

The other is cost, and cost depends a lot on the number of people who take up using a MID. It's still somewhat debatable whether that will happen. Not everyone is going to be happy using a device with a 7-inch screen, a fiddly little keyboard, and limited expandability or functionality.

The chipmakers' best guess is that, provided these things start to sell in volume, in a couple of years' time one of these little MIDs will set you back a couple hundred bucks. But in my opinion, that's still a little high. You can buy pretty reasonable notebooks now for between \$250 and

\$300, and you have to be a pretty special sort of user to want a MID, as well as (never mind, instead of) a notebook. Plus, your cell phone probably won't suddenly stop working in two years' time, and while a number of geeks like overloading their pockets and bags with multiple gizmos, they're not going to provide the level of volume AMD, Intel, and Via need for this "new" category to really start paying dividends. The category, of course, is not

so new—we're in our third generation of MIDs or UMPCs now. Previous attempts to push them failed for precisely these reasons.

We still haven't really gotten to the stage I wrote about last year where a device is so light and so portable that it will be irresistible. You know, with a screen that is paper-light and innards that are fully functional *and* very portable. Personally, I might be tempted to buy a MID if the price ever gets as low as \$200 or so and will fit in the pocket of my leather jacket, with a battery life of five or six hours. The PC industry has really made great strides in almost every technical direction, but the big obstacle to true portability remains battery life. Fuel cells have been touted as the answer, but no one talks much about them anymore.

It's good that the CPU firms keep coming out with bright ideas because some of them do pay off. However, some of us with memories as long as an elephant's have seen many cunning plans by technology companies that have been touted as the Next Big Thing, only to vanish, never to be talked about again. If you mention things like fuel cells, "Concept PCs," and Web PCs to an Intel exec, he or she will most likely look at you all funny, as if you've committed an unforgivable breach of etiquette.

The jury is still out on whether MIDs will be the Next Big Thing or wind up a photo on a milk carton. ▲



Mike Magee is an industry veteran. He cut his teeth on ancient products like the Dragon and the Japanese PC platforms long before the IBM-PC won. He worked for a corporate reseller in the mid-'80s and saw the Compaq 386 sandwich box and every GUI known to humankind. Mike decided that the way to go was the Interweb around 1994 after editing PC mags in the late '80s and '90s. A co-founder of The Register, Mike started the chip-driven INQUIRER (www.theinquirer.net) in 2001. He has contacts from top to bottom in the business, spanning the entire chain, who help him root out interesting rumours and speculation.

Send rumours to "Mad Mike" Magee at mike@cpumag.com

Wagging The Dog

by Rahul Sood

AMD At A Crossroads

In 2006, when AMD started to crack into the mainstream, it landed one of the biggest OEM accounts in the industry, one that very few people expected the company to get. I was convinced it would happen, so sure that I made one of the dumbest bets ever with *The Inquirer's* Charlie Demerjian. I did end up winning the bet (and I have the photo to prove it—head to www.rahulsood.com and search for “bunny bet”), but AMD has made a few moves that I still question to this day.

At the time, for example, AMD had some very compelling offerings at competitive prices. They had a much more efficient processor than the competition, and everyone wanted to work with them. So why is it that the company opened up the floodgates and all but killed its channel business during one of the most insane expansions ever? I never did quite get it; the channel was dry of AMD parts, high-margin parts in particular. In the meantime, AMD was busy ramping up low-margin (possibly even negative-margin) business with one of the world's largest OEMs.

When AMD announced that it was buying ATI, I was quite bullish about the resulting company's prospects. Together, AMD and ATI had the potential to create new products that would allow the company to differentiate itself from its competition in fairly dramatic fashion. The company's vision for its Fusion hybrid would essentially give us a fresh, unique way of designing new, innovative platforms. Frankly, I was hoping that this deal would happen much sooner than it did, but for one reason or another, it wound up taking place very late. Better late than never, I suppose, but there are still many challenges ahead for these guys. For one, Fusion is still a dream—a very pleasant dream for those who like to think about the future of technology, but a dream nonetheless.

So, where does that leave AMD in the grand scheme of things? It is a giant company, completely undervalued from a market capitalization vs. technology standpoint. It has excess capacity and is hemorrhaging money. The biggest reason for its dismal valuation is its excess foundry capacity. How can AMD possibly fix this?

One of my good friends at AMD always says, “We've been here before, we were always

the underdog, and we'll come back again.” Much of this may be true, but I would disagree that the company has been here before. You see, AMD was once an upstart, tiny company striving for relevance. For years, it struggled to position itself as a viable alternative to Intel, and while it took many long years, the company succeeded. It broke into the largest OEMs and is now considered a viable alternative to the market leader.

Trouble is, AMD commoditized itself in the process and went from Gordon Ramsay to Ronald freaking McDonald.

Now the chipmaker finds itself going toe-to-toe with a giant on multiple fronts, and the outcome on each looks increasingly grim. AMD can't win the commodity battle, it certainly can't win the process or volume fights, and its attempt to sell three cores for the price of two at the cost of four is insane!

I have made this suggestion before, but I think it's more likely now than before: AMD should really split the business. No, it should not break off ATI; rather, it should split its operations and become both a foundry and a fabless semiconductor company. This isn't as easy as saying, “OK, let's split.” Doing this would require some serious partnerships with modified agreements and creative accounting, and its x86 contract would need substantial tweaking. More importantly, AMD would have to find someone who wants to invest in its foundry business.

Finding a savvy foundry investor would be like asking Gordon Ramsay to dress up as Ronald McDonald and take over McDonald's kitchen. Then again, AMD could partner with Chartered Semiconductor, TSMC, or perhaps IBM—who knows? Splitting AMD would create a fabless semiconductor company with huge value for Nvidia, or perhaps another partner. We have all seen Jen-Hsun Huang openly attack Intel at what seems to be a most inopportune time for Nvidia . . . maybe this is a hint of things to come.

Whatever the outcome, it's clear that there will be change, and we'll be ready. ▲



Rahul Sood's love for computers started at the young age of 11. Much to the shock and dismay of his parents, he ripped apart his brand-new Apple IIc and painted it red before turning it on. His parents' dreams of having a doctor for a son were shattered when college drop-out Rahul founded what is now one of the most respected high-end computer companies in the world, Voodoo Computers.

Send your opinions to this opinionated guy at rahul@cpumag.com



Look For *CPU* At These
LAN Parties Across The Nation!

06.01.08

FragFest, Traverse City, MI
www.fragfest.com

06.07.08

Jacksonville Gamers June Event, Jacksonville, FL
www.jaxgamers.com

LANmaniac BYLOC LAN Party, Bellflower, CA
www.lanmaniac.com

06.14.08

Intel LAN Fest, Folsom, CA
lanfest.intel.com

Whempy's LAN Party, Columbus, OH
whempyslan.org

06.20.08

FGA LAN 2008, Marion, IL
www.clanfga.com

The Noob Tech LAN Party, Fremont, CA
www.lanparty.thenoobtech.com

06.21.08

FRAGfinity, Oxford, IA
www.fragfinity.com

Intel LanFest: Sacramento, Grass Valley, CA
lanfest.intel.com

NWALAN, Fayetteville, AR
www.nwalan.com

PeaceLoveandRockets, Arlington, TX
www.peaceloveandrockets.org

Whempy's LAN Party, Columbus, OH
whempyslan.org

06.26.08

CarolinaCON, Greensboro, NC
www.ncgaming.com

06.27.08

Atlanta LAN Fest, Atlanta, GA
www.atlantalanfest.com

Lake Effect LAN, Erie, PA
www.lakeeffectlan.com

ZOMG LAN, Chesapeake, VA
zomgslan.com

06.28.08

ATD Arena, Charlotte, NC
www.atd-arena.com

KILANFest, Louisville, KY
www.kilanfest.com

Muncie Gamers, Muncie, IN
www.munciegamers.com

06.28.08

Nor'Easter, New Britain, CT
noreaster.lpane.net

Ultimate Gaming Center LAN Party, Stratford, NJ
www.ugamingcenters.com/Home/tabid/111/Default.aspx

XLAN Gaming, Park Ridge, IL
www.xlangaming.net

07.05.08

LANmaniac BYLOC LAN Party, Bellflower, CA
www.lanmaniac.com

07.11.08

Chris' LAN Fest, GA
cealerslanfest.com/default.aspx

LPB Asylum 12, Gatineau, Quebec, Canada
www.lpbasylum.com

07.12.08

NWALAN, Fayetteville, AR
www.nwalan.com

07.18.08

Americas Army 2008 Chicago LAN,
Chicago, IL
aalan.cyberbawx.com

Lantacular, Cincinnati, OH
www.lantacular.com

PDXLAN 12, Portland, OR
www.pdxlan.net

07.19.08

BRAGcon, Baton Rouge, LA
www.BRAGcon.net

LAN Stanley, San Antonio, TX
www.myspace.com/lanstanley

Whempy's LAN Party, Columbus, OH
whempyslan.org

07.24.08

Fragapalooza, Edmonton, Alberta, Canada
2007.fragapalooza.com

07.25.08

GVCCLAN, Placerville, CA
www.gvcclan.com

Massive LAN, Little Valley, NY
www.massivelan.com

07.26.08

ATD Arena, Charlotte, NC
www.atd-arena.com

LANmaniac BYLOC LAN Party, Bellflower, CA
www.lanmaniac.com

08.01.08

AelatisLAN, Surrey, British Columbia
www.aelatis.com

Digital Storm LAN, Aldergrove, British Columbia
www.digitalstormlan.com

08.05.08

VanLAN, Vancouver, Canada
www.VanLan.ca

08.07.08

Dark LAN, Euclid, OH
darklan.thedarkserver.com

Fragapalooza, Alberta, Canada
www.fragapalooza.com

08.08.08

LAN OC, Ohio City, OH
lanoc.org

08.16.08

LANmaniac BYLOC LAN Party, Bellflower, CA
www.lanmaniac.com

NWALAN Old School, Fayetteville, AR
www.nwalan.com

08.22.08

AELAN, North Vancouver, British Columbia
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www.gvcclan.com

08.30.08

ATD Arena, Charlotte, NC
www.atd-arena.com

09.06.08

LANmaniac BYLOC LAN Party, Bellflower, CA
www.lanmaniac.com

09.13.08

DragonFire LAN, Erie, PA
www.dragonfirelan.com

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Technically Speaking

An Interview With
Art History Professor Joel Snyder

Joel Snyder is a professor in the department of art history at the University of Chicago. Among other courses, he teaches the history of photography and the theory of photography and film. He is the author of several books, including "The Art of Fixing A Shadow" and "American Frontiers: The Photographs of Timothy H. O'Sullivan."

by Barry Brenesal



CPU: Let's begin with some background: 150 jobs are to be eliminated at the Polaroid factory in Norwood, Mass., that has been previously dedicated to both the instant camera and film. Two other factories with a similar focus in Concord and Waltham will be moved onto different technologies, such as flat-screen televisions. These were the last remaining factories that Polaroid used to produce instant cameras, a retail venture that once engaged approximately 15,000 employees. Given the once ubiquitous popularity of the instant camera, those job closings might justifiably be regarded as the end of a popular photography era.

The invention of the instant camera is usually credited to Edwin Land, who first marketed it in 1947, 10 years after he began Polaroid. Was there a perceived need for the instant camera in the marketplace when it was first produced?

Snyder: I don't think so. My recollection is that some people were thinking it would be great fun to have a camera that produced an image on the spot. Land was in the enviable position of having a company behind him, with profits swollen by the second World War.

CPU: Was it a huge success from the first?

Snyder: I know that it was an item of curiosity to a lot of people, but the first system was messy. The camera also

moved in the opposite direction from others of the time that were becoming smaller and smaller—especially amateur cameras, such as box cameras, brownies, etc. But Land offered a camera that was large and bulky, going back to the foldout bellows arrangement of the past. His packaging was interesting, too: brushed aluminum and leather inlay. That style appeared once again years later in the SX-70 of 1972 and was deliberately intended to be reminiscent of the first instant cameras, at least in terms of its materials.

Both my father and an uncle of mine bought these original instant cameras. It was fascinating to use, but it was kind of gawky. It had to be big, because the size of the film was 3-1/4 inches x 4-1/4 inches, with the picture slightly smaller than that. At the end of the development, you flipped the switch on the back of the camera, pulled the paper, and out came a sandwich of the print and negative papers. After a minute, you pulled them apart, when it was still wet and rather smelly. Within a year, though, Land realized the pictures were fading—and that was another reason why it wasn't enormously popular. He then created the coater, a fixing agent that had to be applied to the print, but it never looked right. It always seemed uneven. In short, it was not an ideal instrument.

CPU: Within a few years, though, it became a hit. When did Land succeed in getting rid of many of the negatives you've summarized?

Snyder: My recollection is that the final print was improved from sepia to black and white, and the camera got smaller, but the system remained pretty smelly. Polacolor, which came out in 1967, was like a dream compared to Land's original. Peeling was still part of the process, but there wasn't a lot of it, and the paper wasn't drenched with chemicals. By that point, too, he had produced a system that was no longer dependent upon rolled film, but could use sheets of paper. All this made it immensely cleaner and more usable.

CPU: It became unbelievably popular, didn't it?

Snyder: It did, indeed. I don't know how it did in Europe, but we Americans were unwilling to wait around for a drug-store to develop our film. This, despite being substantially more expensive in terms of the cost per print.

CPU: It became so popular that Polaroid ceased to be the only manufacturer of instant cameras and films.

Snyder: There was the brief dalliance of Eastman-Kodak with instant cameras and film, but it wasn't as good a product, at least in my estimation. It wasn't as easy to use, and it turned out—at least, as far as the courts of law were concerned—Kodak had violated a number of Polaroid's patents.

CPU: Polaroid spent a great deal of money defending their dominance in the instant camera market, but they didn't seem to do very much to develop new ones.

Snyder: I think that there was a fundamental misunderstanding on Polaroid's part of what the future was going to look like. If you look at the history of their products, they were very much captured by photography—first of all, as an amateur or family activity. They also moved very quickly into the production of materials useful to scientists and technologically inclined business: EKG read-outs, astronomical films, etc. In this case, they were modeling themselves, consciously or otherwise, on what

Snyder: I think they suffered from what GM suffers from, and what most large corporations suffer from, especially if the founder is still around. That is, the vision of the founder is both the genius and the limitation of the corporation. I watch this with my students, and I'm now in my sixties. They think about the Internet in a way that I don't. They are merged with the Internet, and they see possibilities that I simply don't see.

I think that Polaroid was led by the same people much too long, who did not bring in youngsters who were enormously successful in what they did. It simply didn't occur to them that anything better would appear.

CPU: I find it amazing, though, that they kept this attitude as late as they did. Polaroid didn't seem to realize that new technologies had arisen and the world had passed them by even in the 1980s.

Snyder: That's true, but look: Let's consider General Motors. They were severely jolted in the early '70s by

research and development, but that they do them following exactly the plans they had 10 years ago.

I don't blame them for this. It seems to me perfectly understandable why people get into a rut. But let me turn the question back to you: Why is it that somebody who invents a remarkable product and cashes in on it doesn't turn around and produce another quite different, but still remarkable product?

CPU: Who stops to think they need to buy more cattle when they already have a cash cow?

Snyder: Exactly. Yet you keep thinking you have to polish that one cow! It isn't specific to Polaroid, either. Eastman, a much larger corporation, suffered from the same disease. Yet it is remarkable that well into the '80s, Polaroid just hadn't gotten a clue. In part, I suspect it is because Land lasted so long, and the people who followed him were handpicked by him. I still find it astonishing.

I think that Polaroid was led by the same people much too long, who did not bring in youngsters who were enormously successful in what they did. It simply didn't occur to them that anything better would appear.

—Joel Snyder

Eastman had done. Eastman produced a broad range of films for very particular markets. Polaroid did the same thing. Polaroid wanted to develop a motion picture system based on their instant technology, too, and they did. But why over the years didn't video occur to them? Why didn't it occur to them that the digital market was coming? I'm not paid to make such prognostications, but some people at Polaroid were, and they completely failed at this.

CPU: Why do you think they did? I mean, this was a company that was exceptionally smart. They made some very good decisions for development and promotion. At least, Land did.

successive small Japanese cars. They saw it coming. Their response was the typical large corporation response of "Let's stop them from entering the country by putting large tariffs on them." Several years went by. How long did it take them to figure out that the Japanese were real competition, and they, GM, needed to produce a better product? How long did it take them to take apart a Japanese car and try to figure out how it was put together? I think people tend to live in cocoons, especially if they're in corporations. It isn't that they don't do

My suspicion is that by the time it was just barely imaginable that this digital stuff was going to be a serious challenge to Polaroid, it was too late. They didn't know where to go. They didn't know how to get into the business, and everyone else was far ahead of them.

CPU: They never did catch up, and went bankrupt in 2001.

Snyder: Then, all of a sudden, they were selling their brand. That's always the kiss of death. **CPU**



Subscribers can read bonus content with Joel Snyder at www.cpumag.com/cpujul08/snyder

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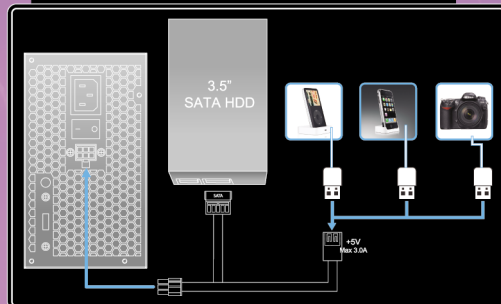
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Under Development

A Peek At What's Brewing In The Laboratory

A New Sensation In Climate Research

Climateologists have it tough. Besides being confused with meteorologists (who study short-term weather systems, as opposed to long-term patterns), reading through climate data is complicated and overwhelming. A typical topographical climate map includes temperature, humidity, wind, and precipitation—each represented by different visual symbols and dimensions such as color, size, intensity, and orientation. Thus, poring over the data can be a complete visual overload, with limited information absorbed by the researcher.

With this in mind, a multidisciplinary team comprising haptic researchers Professor Cagatay Basdogan, Nesra Yannier, and Serdar Tasiran of Koç University in Istanbul, Turkey, and climate researcher Omer Sen of the Istanbul Technical University have worked together to alleviate the difficulty of parsing climate data. Their new, multi-modal interface called CEVIZ (Climate Exploration and Visualization) utilizes a haptic device (in this case, a robotic arm that reflects certain forces against the user's hands) along with a 3D map to integrate more senses into the processing of the data.

Basdogan explains, "Using the haptic device, the user can touch and feel the topography, such as mountains and valleys, and the direction and magnitude of wind forces at a certain pressure level. As the user explores the climate data interactively, s/he can understand better the occurrence of events such as cloud and rain formation and the effect of climate variables on these events."

All experiments Basdogan and his team have run show that users who utilize CEVIZ are much better able to understand cause-and-effect relationships of the data, which resulted in better learning and retention of information. Cost of a desktop haptic system is less than \$250—certainly affordable for most labs.

Basdogan and team are now looking toward the future. By tinkering with their current system, they may add a thermal display for temperature, an auditory display for wind, or vibration for mimicking a rainstorm.

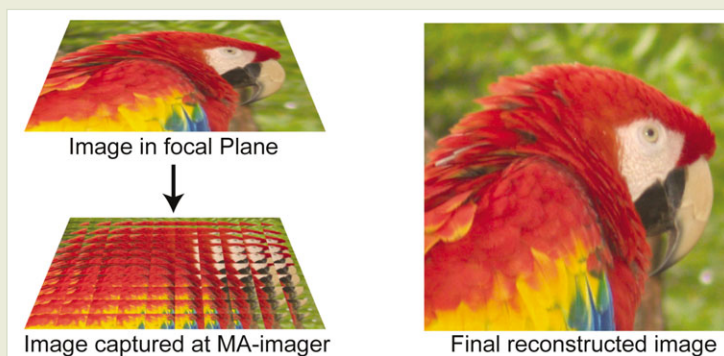
"We believe that as the number of sensory modalities increases, the digestion of climate data will be easier," Basdogan says. ▲

The Better To See You With

There's no argument that today's digital cameras can produce beautiful, crisp, high-resolution images. But no matter how good your photos look, they're still 2D representations of a 3D world. What if you could have your snazzy snaps, plus the ability to manipulate and view 3D versions of those images?

Stanford electronics researchers Abbas El Gamal, Philip Wong, and

If you print the photo or view it on a computer screen, it won't look any different from the photos you can take now, aside from every part of the photo being in perfect focus. But because of the underlying depth information, you could use software to defocus parts of the scene or call out only the image at a certain distance, making the rest of the photo effectively disappear.



Overlapping images captured by subarrays on the multiaperture sensor create both a crisp 2D image and a 3D depth map of each point in the scene.

Keith Fife are developing just such a camera. Instead of having just one lens as conventional cameras do, their camera will have thousands.

The trick behind this feat is what the team calls a "multiaperture image sensor," which involves placing a tiny lens atop an array of 256 pixels. Rather than focusing the image directly on the image sensor as a regular lens does, the lens of the multiaperture camera focuses about 40 microns above the sensor array. In doing so, each point in the photo is captured by at least four sensors, each at a slightly different location. This overlapping view creates a depth map to every point in the resulting photograph.

Another difference built into the multiaperture sensor is the pixel size. In order to capture more fine-grained depth information, the sensor uses smaller pixels (0.7 microns) than a standard digital camera. The smaller pixels are able to provide a more accurate depth map, and because more of them will fit on a sensor, they could produce higher-resolution images and provide redundancy for failed pixels.

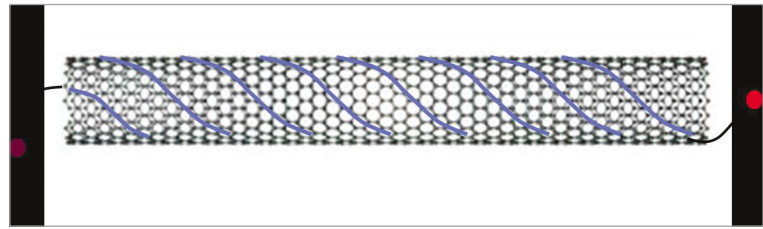
According to a Stanford press release, the team is currently fine-tuning the manufacturing process for creating the camera chip's micro-optics. The camera shows great promise for security applications, as well as 3D modeling and biological imaging. ▲

CREDIT: KEITH FIFE, STANFORD UNIVERSITY

DNA Takes On The Chip Industry

Not satisfied with simply being “the building blocks of life,” DNA has just stepped into the role of engineer to help out chipmakers with their dream of self-assembly. IBM researchers Jennifer Cha and Greg Wallraff are part of a team that has been working with lithographic templates to cajole laboratory-created DNA to self-assemble into particular shapes, which act as scaffolds for carbon nanotubes (strands of carbon atoms that can conduct electricity) or semiconductor nanowires. Once the nanotubes have assembled themselves into a desired array, the DNA can be removed, leaving the specially arranged nanotubes and wires to function as electrical circuitry.

DNA, shown here wrapped around a carbon nanotube, provides a template for the nanotube to form a particular structure.



CREDIT: IBM ALMADEN RESEARCH CENTER

Although this sounds pretty straightforward, the difficulty of getting a biological system (DNA) to recognize and work with a nonbiological one (carbon nanotubes) is considerable. “Essentially, we are developing new chemistry to direct both the synthesis and assembly of nanoelectronic materials on DNA scaffolds,” explains Sara Delektu Galligan, communications representative at the IBM Almaden Research Center.

Another challenge for the team has been analyzing how the DNA binds to the lithographic templates. In fact, the technique used in the studies, atomic force microscopy, which uses a high-res scanning probe microscope that “feels” the nanoparticles to display them, is excruciatingly slow, leaving the team with plenty of time to formulate new experiments in manipulating DNA, but no time to actually do them.

The research is still highly theoretical, but it could be a boon to the industry, reducing manufacturing costs by phasing out pricey production systems and considerably reducing the size of chips. Currently, chip size can be as small as 45nm, but with IBM’s research, they could be made as small as 4 to 6nm. That said, at the earliest, actual fabrication of such a chip could be 10 to 20 years from now, Galligan says. ▲

Avatars Get Real

Soon you may have a more pressing issue than trying to figure out if the avatar you’re flirting with in Second Life *really* is a hot, single young thing: You might have to discern if said avatar is guided by a human at all. A team of researchers from Rensselaer Polytechnic Institute have created “Eddie,” an avatar in Second Life who has the reasoning abilities of a real 4-year-old. This engineering in AI results in Eddie being able to interact with human players, predicting and manipulating their behavior.

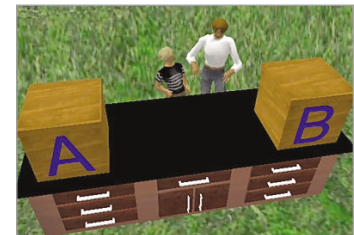
According to the project’s lead, Selmer Bringsjord, the team’s aim is not to create an algorithm that explains and predicts the behavior of humans. Instead, the team wants to program artificial intelligence that is “more

interesting and useful” because of its ability to recognize human emotional and intellectual states. In addition, this AI could reason about such states and, as an avatar, mimic a human’s experience.

“More interesting and useful” results in an avatar that would be convincing enough to pass as a real human or that could act as an autonomous intellect—an avatar with memories and intentions. In order to accomplish this with Eddie, Bringsjord’s team has utilized the processing backend of a supercomputer coupled with logic-based artificial intelligence and computational cognitive modeling techniques. The core of the programming is being done around something called “theory of mind,” which is a state of cognition where a person (or AI)

understands his/her/its own mental state and is also able to understand that others’ states may be different.

To assess their programming, the researchers put Eddie through what is called a false-belief test. In Second Life, they placed Eddie and two other avatars in front of two boxes with a teddy bear. The bear was placed in box A. One of the avatars was asked to exit, and the remaining avatar moved the bear to box B. The avatar asked Eddie where he thought the other avatar would look for the bear upon his return. As a 4-year-old, Eddie’s theory of mind is unformed, and he incorrectly predicted that the returning avatar would look for the bear in box B, instead of where the returning avatar



CREDIT: RENSSELAER POLYTECHNIC INSTITUTE

“Eddie,” an avatar with the reasoning capabilities of a real 4-year-old, is run through a test of his cognitive skills by Rensselaer researchers.

last saw it. However, once Eddie learned of his mistake, his reasoning improved and he could give the correct answer if asked again.

Although obvious applications for AI avatars such as Eddie are gaming and entertainment, Bringsjord points out that education and homeland defense are also viable possibilities for future use of the technology. ▲

Q&A With Jon von Tetzchner

Jon von Tetzchner is the founder and CEO of Opera Software, the publicly traded company in Oslo, Norway, that makes the Opera Web browser. Since 1994, von Tetzchner and his team have been working on Web browsers. Now their browser is in version 9.5, and it is being used by more than 100 million people across the planet. There are even, von Tetzchner notes, seven Opera browser users in the Vatican. The company has battled against big rivals such as Microsoft and Apple, and it has had to deal with competition from the nonprofit Mozilla and its Firefox browser.

Q Please tell us a history of Opera.

JvT Opera has been around a fairly long time. We worked at a research lab in 1992 and 1993. It started as a research project at what used to be the state-owned telecommunications company, Norwegian Telecom Research, or Telenor. We stumbled across the Web. We put up the first Web server in Norway. We decided to make a browser. Work started on Opera in 1994. The company was founded in 1995 with two of us, myself and Geir Ivarsoy. A couple of geeks working at Telenor Research. That was our beginning. We negotiated a deal with Telenor to go off on our own, and we founded the company with \$7,000 in start-up capital. Our first deliveries were on Windows on the desktop.

Q How many users do you have?

JvT On the desktop, our active users are something like 20 million. There are a fair amount of downloads every day. The active user base is growing fairly rapidly. On the mobile side, we have 40 million users of

Opera Mini. We have also significant deployments of Opera Mobile. We don't have as accurate numbers as we do on Mini. We have more than 100 million deployments on different devices. We have 100,000 downloads of Opera Mini per day.

Q What is your market share in desktops?

JvT It's about 2%. It varies a lot from country to country. In some, we are more than 10%.

Q Where is most of your growth going to come from?

JvT From everything we do. We have significant growth on desktops. It's a little over 50% growth in users last year. That helped on the revenue side. We continue to grow in mobile and on devices. Mini is a free product, as well. It's by far the most popular mobile browser to access the real Internet at this time. People are browsing more than 2 billion page views a month.

Q How is Opera doing on the Wii?

JvT It's doing well. I am not allowed to tell you exactly. You know how popular the Wii is. In the beginning, [Opera] was a free download. Now it costs 500 Wii points or \$5. That's not a lot of money.

Q Is it proving that people do want to surf from a Web console?

JvT I believe the Wii is the No. 1 way to surf the Web from a TV.

Q What can you say about the speed of the browser and memory footprint?



JvT We've always had a reputation of having the smallest footprint of any browser and having the fastest browser. We are working hard to maintain our position as the smallest, most efficient browser.

Q What are changes you foresee in the future?

JvT The things we have been talking about. The Web is going to be everywhere. We've been saying this for many years, and now it is happening.

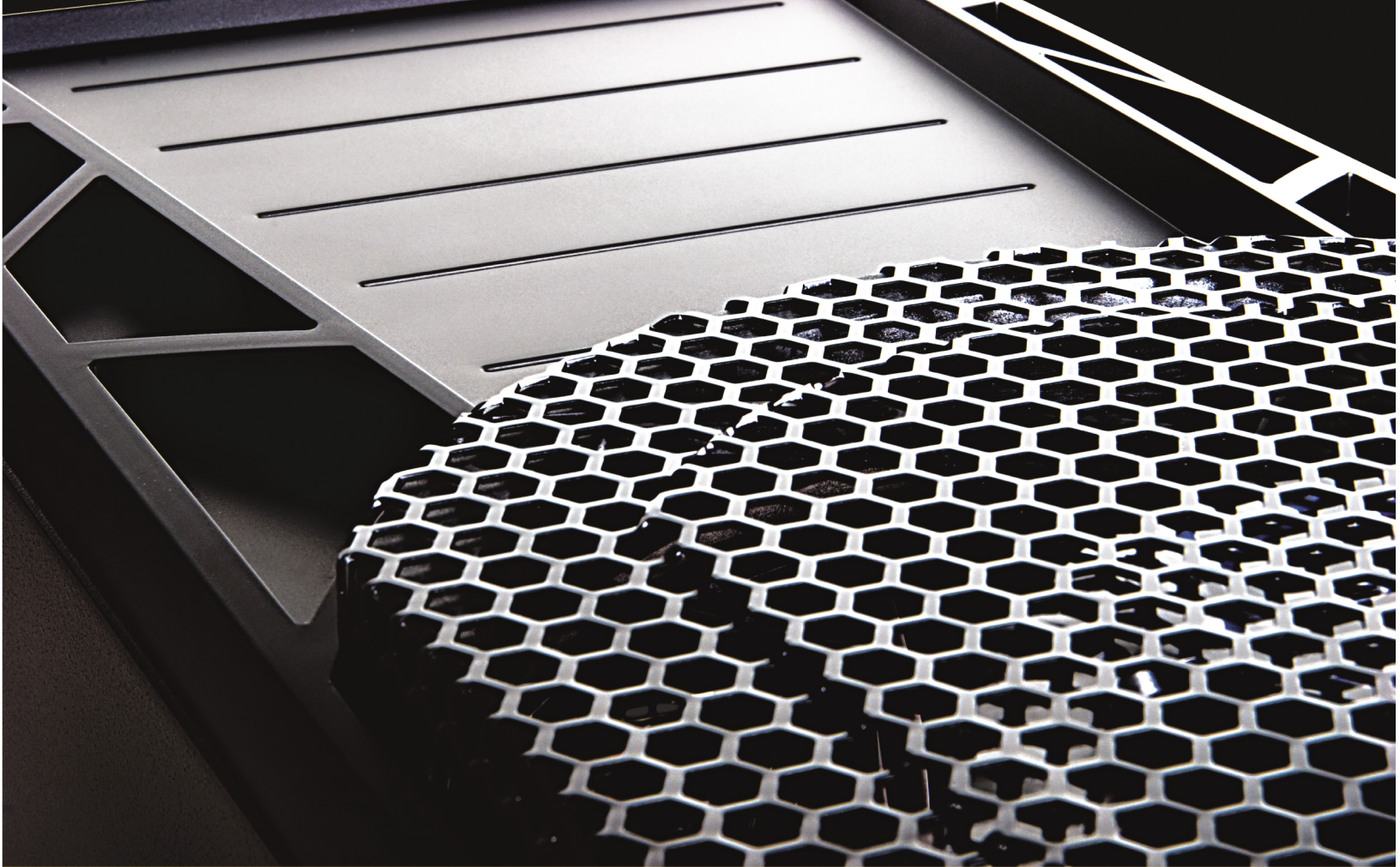
Q How concerned are you about Microsoft's market power and antitrust issues?

JvT We are. One of the things we've seen concerns the importance of Web standards. We're pushing Microsoft to follow them. We're having success. The next version of IE will be more standards based.

Q What are the next steps to watch for in standards development?

JvT The standards are easy to define. It's about WC3. That is mostly our focus. HTML 5. Microsoft is the main editor of that standard. There are scalable vector graphics. If they don't follow it, the standards have no meaning. The more aligned the browsers are, the better. ▲

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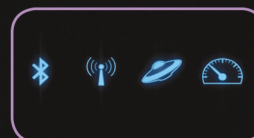
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